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Technological factors in the

Expansion of Agricultural Production In West Europe

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U. S. DEPARTMENT OF AGRICULTURE

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Summary

Farming in West Europe showed considerable progress in technology during the interwar period, but this progress was largely confined to a few advanced countries or advanced segments of the farming communities. Science was far ahead of the practical application of its results on West Europe's farms.

Developments since the end of World War II have changed this picture. Powerfully stimulated by the loss of farm labor to a booming industry, and with government aids to promote better methods, West European farmers have become increasingly progress-minded. Science has found its way onto the average farm.

By 1955, tractors numbered 10 times as many as before the war, and 1956–57 brought further increases. The input of fertilizer rose by almost 80 percent over prewar. In England and Wales, Denmark, and Sweden, fully 80 percent of all cows are being milked by machine. Examples of the progress made could also be drawn from other fields, such as grassland management, plant and animal breeding, livestock feeding, and control of diseases and pests.

Total agricultural production in West Europe now stands about one-fourth above prewar, a 10-percent increase on a per capita basis. Allowing for the fact that the post-recovery period beginning about 1950 was favored by good weather, the increase in total output in the first half of the 1950's may be estimated at 16 percent, or 2½ percent per year. Only one-fifth of this increase in output can be attributed to larger inputs; fully four-fifths was due to an increase in total productivity of 2 percent per year—in turn, largely the effect of better technology actually applied. Labor productivity has increased by 4 percent per year.

These rates of growth in farm production and productivity have no parallel in West Europe's past history and compare favorably with rates of growth in the 1940's and 1950's in the United States.

Opinions as to the extent of probable further expansion in West Europe's agriculture over the next decade or so must necessarily differ. But few will quarrel with the view that the growth of total output and of productivity is likely to continue at high rates. It is therefore probable that West Europe's farm production will become more genuinely competitive—for technological reasons and even without intensification of government support. It is important to be aware of this prospect in an area that is the world's largest importer of farm products and that, in recent years, has taken nearly 40 percent of United States agricultural exports.

Better farming still faces many problems in West Europe. But the record of the past, especially of the last 10 years, furnishes ample evidence that, given favorable economic conditions, West European agriculture can overcome to a large extent the obstacles to technological progress that are inherent in a farm structure with strong roots in the past.

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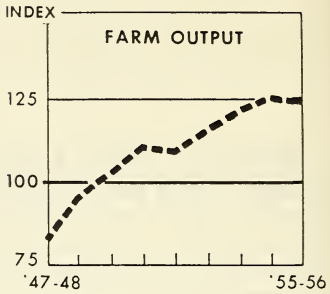

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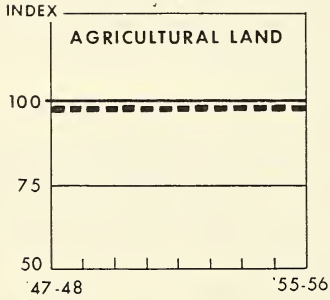

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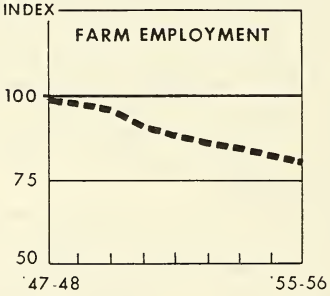

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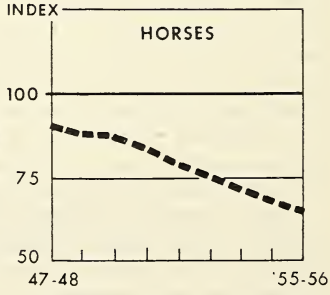

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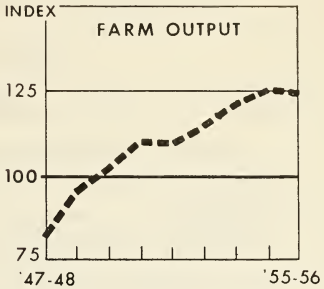

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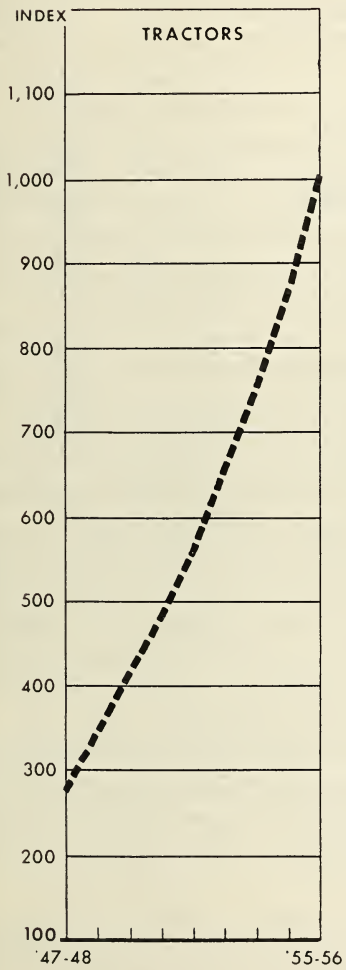

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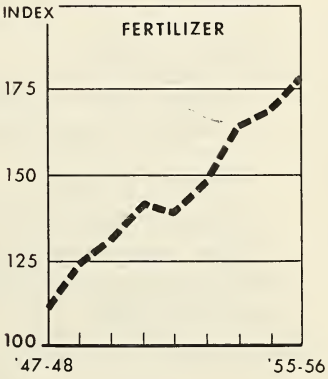

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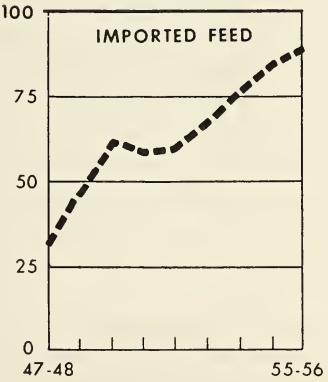

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Technological Factors in the Expansion of Agricultural Production In West Europe

By Karen J. Friedmann, Lois B. Bacon, and J. H. Richter
European Analysis Branch, Foreign Agricultural Service

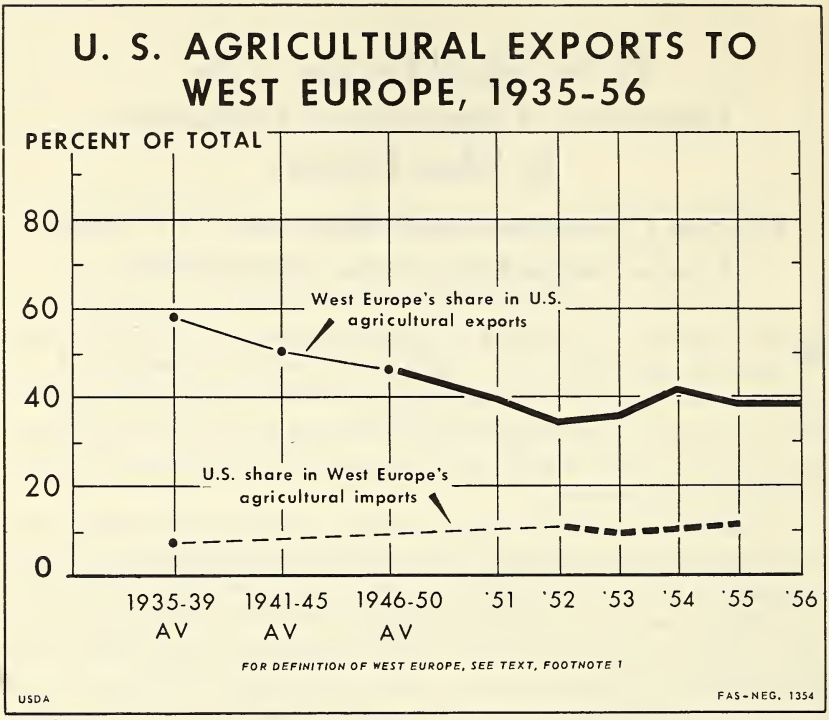
West Europe is a market of great importance to United States agriculture. The area [1] has taken nearly 40 percent of our agricultural exports in recent years. These shipments represent about one-tenth of total agricultural imports by the West European countries, and nearly one-fifth of the imports of products of interest to United States farmers.

In Europe, as in other foreign markets, demand for United States farm products is determined by total effective requirements and by the competition that our products meet in those markets. American agriculture's most formidable competitors in West Europe are not other overseas exporters but the West European farmers themselves. Although they produce no raw cotton and only a fraction of the needed tobacco supply, they do provide about two-thirds of the caloric value of the area's food needs. Agricultural production and productivity in West Europe are, therefore, a major factor in the competition met by American agriculture in foreign markets.

European agriculture's competitive strength is determined by many factors. It is clear that general economic developments and policies, especially agricultural policies, exert and have exerted a great influence. Other important factors are the natural environment and the agrarian structure (size of farms, fragmentation of holdings, tenure) characteristic of agriculture in a given country or area. Finally, there is the organization of production—the pattern of technology and the technical and business management that characterize individual farms and the agriculture of whole districts or even countries.

It is with technological developments as factors in the postwar expansion of agricultural production and productivity in West Europe that the present study is concerned. By their nature, these factors are not so much the tools of a policy aiming to increase total production as they are the outgrowth of efforts to raise productivity. The progress

[1] In the terminology of this report West Europe includes Austria, Belgium, Denmark, France, West Germany, Ireland, Luxembourg, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom. Excluded from the area are the Mediterranean countries, since conditions there differ too greatly to permit of common treatment with the region as here defined.



of technology has been stimulated by favorable price-cost relationships and greater availability of loan capital. But interest in technology as such has become a widespread and increasingly powerful force, tending to raise output per unit of input, and thus itself improving price-cost relationships and reducing the capital-output ratio.

This study will single out the most important lines of technological progress [2] that have been observed in West Europe since the end of the war, and give an idea of their combined and, in some instances, individual impact. An attempt will also be made to open up some vistas on the further development of agricultural productivity and, therefore, of production.

First, however, a brief summary of the policies applied and of the influence of general economic developments would seem to be in order. Thereafter, a glance at the main characteristics of West European agriculture will throw some light on its natural setting and its structure. The stage will then be set for the theme of technology and agricultural expansion.

[2] The technology to be discussed is technology of farm production. No reference will be made in this study to technological advances in processing or distribution of farm products.

Policies

Policies for agriculture aim mainly at increasing agricultural output or per capita farm income or both. To be effective, the policies must overcome deficiencies in natural, economic, and human resources that may impede progress toward those aims. The countries' policies thus appear as efforts either to offset or to correct such drawbacks; usually they are a mixture of both. The "offsetting" type is more protectionist in character, concerned mainly with expanding total output. The "correcting" type is more forward looking and mainly concerned with per capita income and with raising productivity.

In pursuit of these production and productivity aims, a few concrete measures stand out as tools of policy. In nearly all countries, import controls—high tariffs, equalization fees, or quantitative restrictions—are of considerable importance, but in degrees varying by commodity. Government trading and trade monopolies are still widespread (France, Germany, Austria, Switzerland, Norway), while assistance to exports through subsidies is on a modest scale, except in France. Fixed or controlled prices for key products are a general feature in Europe; direct deficiency payments are important in the United Kingdom only. Producer subsidies, predominantly for small farms or those in disadvantageous locations, are observed in a number of countries, while subsidies for such input items as fertilizer, machinery, and motor fuel are widely applied. Consumer subsidies are in some cases given to offset the effect of high farm prices or as an alternative to producer subsidies.

Consolidation of small and scattered holdings is badly needed and being attempted in greater or lesser degree over most of Europe. To assure success, most governments aim to link other improvements with consolidation, although this increases the costs of consolidation. Research and extension services, farm credit facilities, and measures to promote technical rationalization of farming range from well-developed undertakings to modest beginnings, but everywhere policies aim to improve them.

General Economic Development

General economic development and the progress toward higher levels of industrialization and commerce have a great influence upon productivity in agriculture. From 1947 to 1956 the Gross National Product of West Europe rose by over 60 percent—or at a compound rate of 5½ percent per annum. The area's volume of total exports tripled; total imports more than doubled. Gold and foreign exchange holdings doubled.

This postwar expansion of West European industry and trade, the

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growth of population and per capita income, and the improvement in general levels of living have stimulated agricultural output in many ways. The growth of demand, both quantitative and qualitative, has been a powerful force. The expansion of industry and the rise in industrial productivity and wages have progressively reduced the labor force available to agriculture. The rising cost of labor has stimulated labor-saving mechanization of agricultural operations and more efficient management in general. And the expansion of industry has at the same time provided the tools for such progress.

In fact, it is this general economic development that has been the prime mover for increases in the productivity of agriculture in West Europe. The sequence of events is something like this: General economic expansion, higher industrial wages, decline in the farm labor force, higher agricultural wages, greater profitability of labor-saving input in agriculture and general pressure toward more efficient management, higher agricultural productivity. The expansion of secondary and tertiary industry in West Europe not only absorbed all the new labor force that population growth furnished since before the war, but it also took labor away from the farms. West Europe's agriculture today produces one-fourth more than before the war, with one-fifth less labor—a relationship that in itself is the expression of a formidable increase in agricultural productivity.

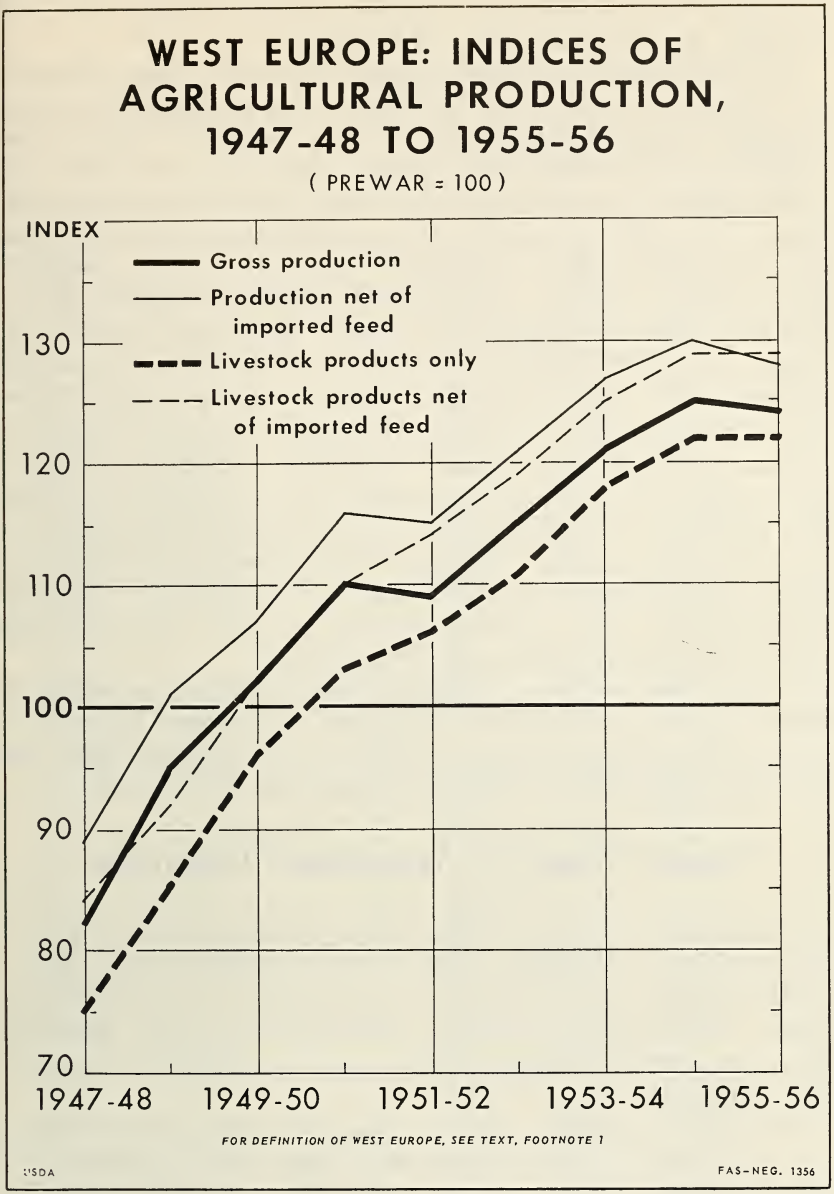
West Europe's Agriculture

Mixed farming, with emphasis on livestock, is characteristic of West Europe's agriculture. Livestock products are the chief source of farm income. Climate and soils are favorable for grasslands over most of the area, and forage crops cover a large part of the agricultural land.

Wheat, rye, and potatoes are grown both for food and for feed. Sugar beets are produced in all countries except Norway. Truck farming is frequent near large consuming centers and is a significant specialty of agriculture in parts of the Netherlands, Belgium, France, and West Germany. Fruit orchards are common throughout the area. Wine is a major specialty in France, and a minor one in West Germany, Austria, and Switzerland.

West Europe's farms are more often than not family farms, operated by their owners and worked mostly with the aid of the family. They are of fairly substantial size in the United Kingdom, Denmark, and France, but prevalently small in the rest of the area; the *average* size ranges from 12 acres in Norway to 65 acres in the United Kingdom.[3] According to the findings of a report by the Organization for

[3] Excluding "rough grazings." In Belgium the average size of all farms is only 4½ acres; however, if the very large number of dwarf holdings (on which farming is only a part-time occupation) is not counted, the average size comes to 17 acres.



European Economic Cooperation (OEEC),[4] the main problem of the agricultural economy of the European countries is the importance in it of small farm units, many of which do not have the natural, human, and economic resources that permit the application of modern

[4] *Agricultural Policies in Europe and North America*, First Report of the Ministerial Committee for Agriculture and Food, OEEC, Paris, May 1956.

techniques of management. Another serious problem, in most countries, is the fragmentation of holdings.

Of the total agricultural area of nearly 250 million acres, 44 percent is in temporary or permanent grassland and an additional 17 percent in rough grazings. Furthermore, over half of the 56 million acres sown to grains is devoted to feed grains. Since some of the remaining arable land also is under feed crops—fodder beets and potatoes among them—and a part of the food crops is used for feed, it is certain that more than three-fourths of the area's farmland produces feedstuffs for its livestock industry. Nevertheless, additional feedstuffs are imported in substantial quantities, especially grains and oilcake. The region's livestock population includes 60 million head of cattle, 43 million hogs, 41 million sheep, 370 million fowl, and 5 million horses.

In food production the region, as already stated, has achieved a degree of self-sufficiency of about two-thirds. Among food imports, bread grains, fats and oils, sugar, and fruits are the most important. Due mainly to the United Kingdom's requirements the area is also a net importer of meats. Exports of dairy products and eggs, primarily from Denmark and the Netherlands, approach in value the total imports of these products by other countries in the area, primarily the United Kingdom and West Germany.

In 1955 food and feed, including oilseeds and oil, accounted for 69 percent of the value of the area's total agricultural imports; tobacco accounted for 4 percent, cotton for 7 percent, and other raw materials of agricultural origin including wool for 20 percent.

Recent Trends in Agricultural Production

Agricultural production in West Europe, which declined appreciably during or immediately after the Second World War, made a rapid recovery in the late 1940's, and since then has continued to increase. In 1955–56, agricultural production stood about one-fourth above the prewar average, compared with a population increase of only 13 percent.

The period of postwar recovery—roughly to 1950—saw an increase in farm output of about 8 percent per annum, while the post-recovery rate of increase to 1956 amounted to about 2½ percent per year. Two and one-half percent, by all standards of the past, is a remarkable rate of increase which, even though it was favored by good weather, indicates a decisive increase in productivity compared with the prewar period: Higher production per man, per acre, and per animal. The labor force has continued to decline; acreages, on the whole, are below prewar; and imports of feedstuffs are measurably smaller than in prewar days. It is true, of course, that increasing mechanization and

West Europe: Indices of agricultural production, prewar and selected years 1947–55 [1] [2]

Country and year	Gross [3]		Net [4]	
	Total	Livestock products only	Total	Livestock products only
Austria:				
Prewar	100	100	100	100
1947	66	60	71	67
1950	92	86	95	89
1954	106	106	108	109
1955	112	108	115	111
Belgium:				
Prewar	100	100	100	100
1947	88	80	104	99
1950	111	102	127	121
1954	124	119	137	135
1955	130	120	144	136
Denmark:				
Prewar	100	100	100	100
1947	84	74	93	83
1950	116	104	123	110
1954	127	121	130	123
1955	125	118	126	118
France:				
Prewar	100	100	100	100
1947	84	86	87	91
1950	109	107	112	111
1954	126	126	130	133
1955	125	127	128	132
West Germany:				
Prewar	100	100	100	100
1947	70	56	74	61
1950	103	94	106	97
1954	120	117	122	119
1955	119	120	121	122
Ireland:				
Prewar	100	100	100	100
1947	84	81	87	83
1950	97	93	98	94
1954	112	107	114	108
1955	105	101	108	104
Netherlands:				
Prewar	100	100	100	100
1947	76	65	84	74
1950	115	111	124	122
1954	131	129	137	137
1955	133	134	136	138
Norway:				
Prewar	100	100	100	100
1947	94	88	101	94
1950	116	112	125	121
1954	120	116	122	118
1955	127	125	124	121
Sweden:				
Prewar	100	100	100	100
1947	104	106	105	108
1950	121	113	123	115
1954	121	111	124	114
1955	113	110	113	111

See footnotes at end of table.

West Europe: Indices of agricultural production, prewar and selected years, 1947–55—Continued

Country and year	Gross [3]		Net [4]	
	Total	Livestock products only	Total	Livestock products only
Switzerland:				
Prewar	100	100	100	100
1947	90	82	89	79
1950	110	99	109	97
1954	117	109	116	107
1955	114	109	113	108
United Kingdom:				
Prewar	100	100	100	100
1947	94	81	118	108
1950	120	109	148	143
1954	137	136	160	167
1955	133	131	156	164
The area:				
Prewar	100	100	100	100
1947	82	75	89	84
1950	110	103	116	110
1954	125	122	130	129
1955	124	122	128	129

[1] Prewar estimates of production of individual agricultural commodities are mostly official estimates and mostly refer to the period 1933–37; in a few cases it seemed necessary to correct for biased reporting. Postwar estimates of production of individual commodities have, in a large number of cases, been revised for underreporting in the early years. Estimates of utilization of supplies are those of the Foreign Agricultural Service. For the method used in constructing the indices, see *Agriculture Monograph* 10, July 1951.

[2] Year beginning July 1.

[3] No deductions made for the value of imported feed (as part of the feed supply from which domestic livestock was produced).

[4] Excluding the value of imported feed (as part of the feed supply from which domestic livestock was produced).

European Analysis Branch, Foreign Agricultural Service, May 1957.

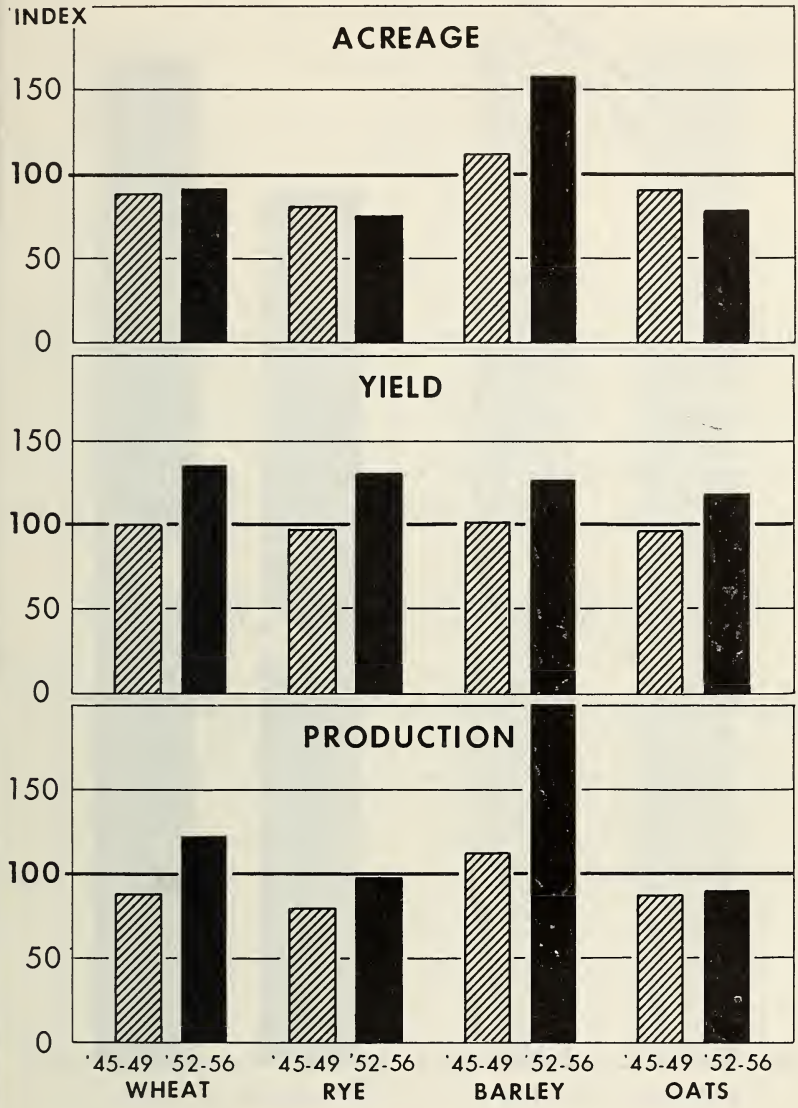
other improvements imply a larger input of capital, but on the whole there is little doubt that much of the increase in production came from higher output per unit of total input.

Though the increase in total production was quite general, there was considerable variation in the degree of increase as between products. Thus, fruit output in recent years has averaged 70 percent above the mid-30's, sugar output 50 percent, egg output more than 25 percent, and milk output about 10 percent. The area's consumption of these products has also increased.

Total production of major grains is running some 20 percent above the prewar level, the production of potatoes about 10 percent above. While wheat production has increased by as much as total grain, the output of rye has remained at the prewar level, in line with the shift in consumption from rye bread to wheat bread. Barley production

WEST EUROPE: INDICES OF ACREAGE, YIELD, AND PRODUCTION OF MAIN SMALL GRAINS

(1935-39 = 100)



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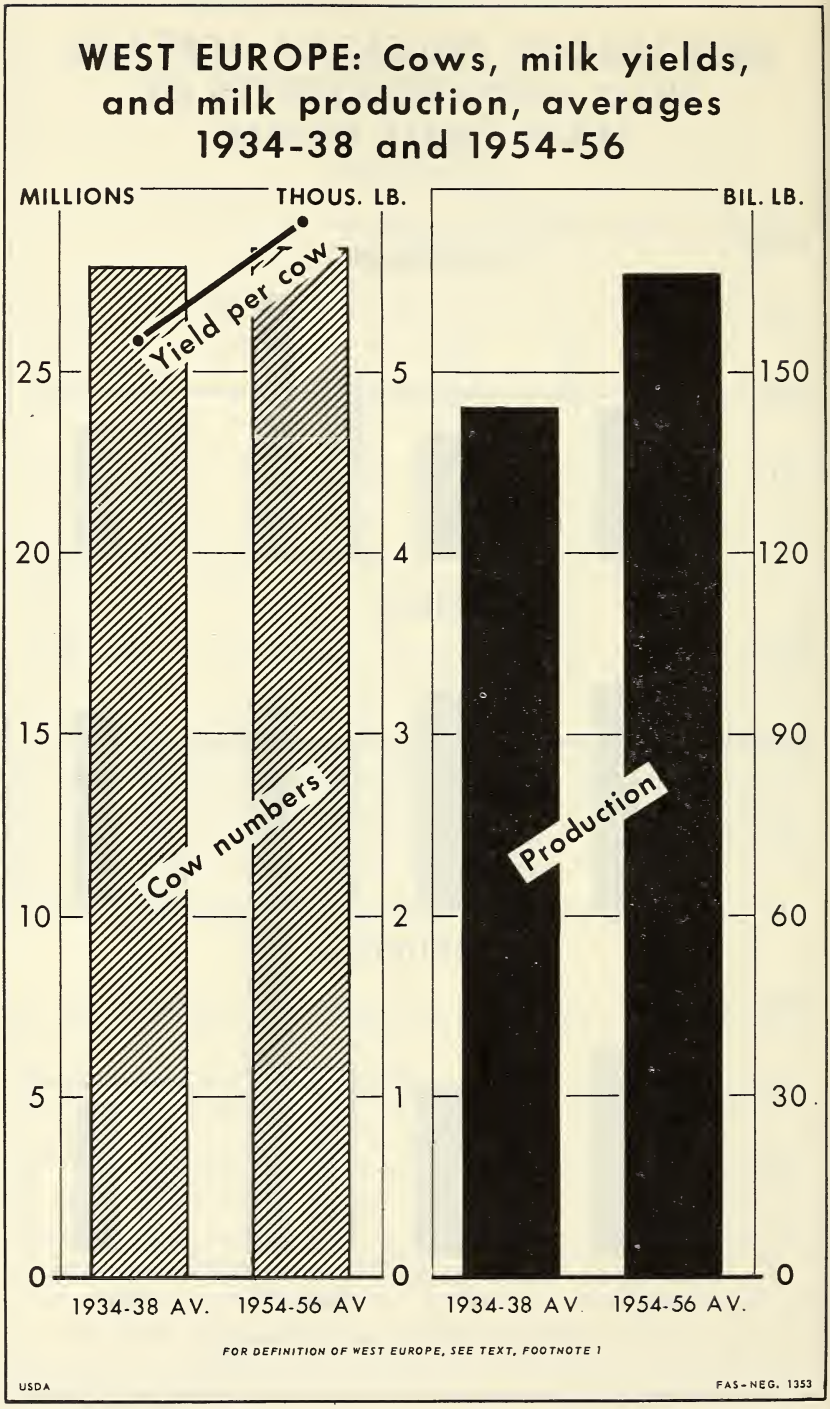
WEST EUROPE: Cows, milk yields, and milk production, averages 1934-38 and 1954-56
MILLIONS
THOUS. LB.
BIL. LB.
Yield per cow
Cow numbers
Production
25
20
15
10
5
0
5
4
3
2
1
0
150
120
90
60
30
0
1934-38 AV.
1954-56 AV
1934-38 AV.
1954-56 AV.
FOR DEFINITION OF WEST EUROPE, SEE TEXT, FOOTNOTE 1
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shows the most striking increase, having doubled in quantity. Production of oats continues on the decline; there was a drop of more than one-third in the number of horses.

In a study concerned with farm technology, changes in yield per acre are of particular interest, especially in an area such as West Europe where output per unit of land—at least until recently—has been considered more significant than output per unit of labor. Grain yields per acre are high. For the area as a whole, rye now averages about 36 bushels per acre, wheat 37 bushels, barley nearly 50 bushels, and oats 60 bushels. Compared with the corresponding 1935-39 levels of yield per acre, wheat shows the greatest improvement with an average increase of about 40 percent; rye yields increased by nearly 35 per cent, barley by 30 percent, and oats by 20 percent. In favorable years, wheat yields in the Netherlands and Denmark have averaged as high as 60 bushels per acre.

It is a well-known fact that increases in output of livestock products per animal unit are more difficult to achieve than increases in crop production per unit of acreage. Nevertheless, milk yields per cow, which for the area average over 5,800 pounds annually, are now some 12 percent higher than before World War II, and West Germany and the United Kingdom register increases by nearly 20 and 15 percent, respectively. There has also been an increase in egg output per hen, but the size of the increase cannot easily be measured owing to inadequacies of poultry and egg statistics.

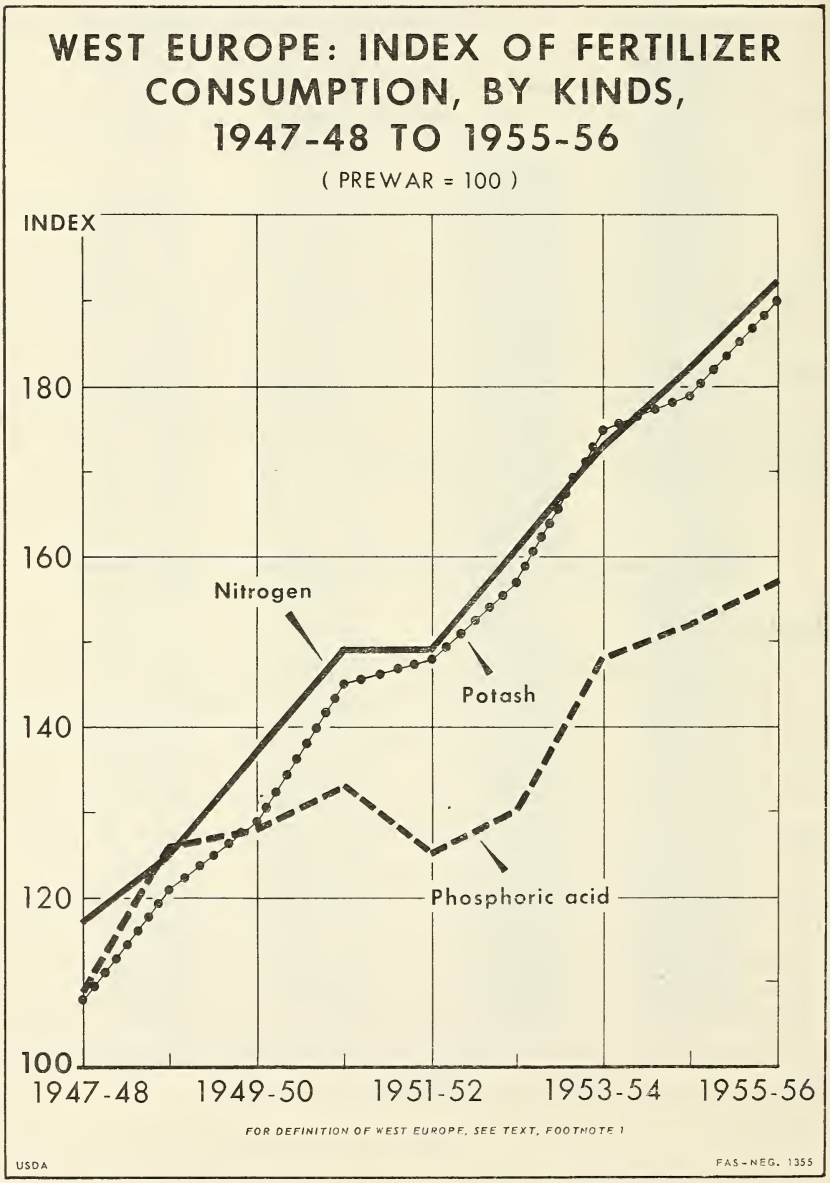
Technological Factors in Postwar Expansion

Land Use

The total acreage in agricultural use in West Europe now is about 2½ percent below what it was before the war. Shifts in land use do not, on the whole, indicate an intensification of land use in the sense of shifts from lower-yielding types of crops to higher-yielding types. Grasslands are no exception. It is true that the area under permanent grass (including rough grazings) declined compared with prewar days (by 4½ million acres, or approximately 4 percent), and the higher-yielding temporary grasslands increased by almost as much. However, the higher production obtained from temporary grassland compared with permanent may, with as much logic, be considered as higher yield from the same basic usage of the land, rather than as a shift toward higher-yielding land uses. One must look to the factors which result in increased yields per acre of land for the explanation of greater food and feed crop production.

Fertilizer Use

In the situation that faced West European agriculture at the end of World War II, increased applications of fertilizers offered the chief means of restoring crop production quickly. Countries with access to the raw materials had encouraged fertilizer consumption during the war, but many others were forced to reduce the use of at least certain



West Europe: Fertilizer consumption by country, prewar and selected years 1947–55 [1]

Item and year	Austria	Belgium [2]	Denmark	France	West Germany	Ireland	Netherlands	Norway	Sweden	Switzerland	United Kingdom	The area
	1,000 metric tons	*1,000 metric tons*	*1,000 metric tons*	*1,000 metric tons*	*1,000 metric tons*	*1,000 metric tons*	*1,000 metric tons*	*1,000 metric tons*	*1,000 metric tons*	*1,000 metric tons*	*1,000 metric tons*	*1,000 metric tons*
Nitrogen:												
Prewar [3]	10.9	60.0	37.0	218.0	345.0	6.0	86.0	10.0	26.0	2.0	66.0	866.9
1947	18.0	82.1	38.0	236.0	261.0	3.0	116.0	23.0	38.0	9.0	188.0	1,012.1
1950	22.5	79.2	70.0	306.0	362.0	8.1	116.0	31.0	68.0	7.9	219.0	1,289.7
1954	29.8	97.1	76.1	347.9	452.5	14.4	187.0	35.6	77.2	11.0	252.2	1,580.8
1955 [4]	30.0	85.8	89.7	381.1	470.1	15.0	182.9	35.4	80.5	11.0	284.0	1,665.5
Phosphoric acid:												
Prewar [3]	17.2	70.1	68.0	425.0	413.3	22.0	97.0	15.0	59.0	24.0	178.0	1,388.6
1947	16.0	92.7	71.0	418.0	215.0	22.0	137.0	26.0	74.0	36.0	402.0	1,509.7
1950	39.2	84.2	83.0	444.0	418.0	61.0	120.0	34.0	106.0	33.0	430.0	1,852.4
1954	44.2	97.2	90.1	669.5	518.3	55.7	109.3	38.0	104.1	40.0	340.0	2,106.4
1955 [4]	49.6	97.6	98.2	727.4	470.1	63.9	111.1	34.9	104.6	41.5	387.0	2,185.9
Potash (K_2O):												
Prewar [3]	10.7	57.3	41.0	295.0	633.0	8.0	111.0	15.0	31.0	9.0	74.0	1,285.0
1947	14.0	123.1	62.0	400.0	405.0	7.0	100.0	33.0	53.0	14.0	183.0	1,394.1
1950	25.0	152.1	101.0	413.0	659.0	21.3	155.0	41.0	53.0	18.0	230.0	1,868.4
1954	50.2	140.5	144.7	517.9	859.2	37.9	146.1	47.6	83.3	21.0	257.0	2,305.4
1955 [4]	48.8	152.2	157.0	581.2	839.5	43.0	165.0	48.0	87.7	22.0	294.0	2,438.4

[1] Year beginning July 1.
[2] Including Luxembourg.
[3] Average 1934–39 for the United Kingdom; single year, or 3- or 4-year average within period 1936–39 for other countries.
[4] Preliminary.

OEEC, "Agricultural and Food Statistics," 1956.

types. The need for increasing consumption of chemical fertilizers in the late 1940's was the greater since livestock herds, and therefore manure supplies,[5] were much below their prewar levels. Fertilizers also had a key role to play in the productivity efforts of the post-recovery period.

Consequently, steps were taken to promote the use of fertilizers. The governments of several countries, such as the United Kingdom, Norway and West Germany, subsidize fertilizer use by making the fertilizers available below cost or by providing for reduced cost of transportation. Tax reduction on fertilizers is the method applied in France. Extension services have emphasized the need for greater applications in most countries. The importance of soil analysis for maximum effect of fertilizers is recognized by the fact that some countries provide this service free (the United Kingdom and Ireland) or at reduced cost. Production of fertilizers has also been stimulated.

Even where no artificial means have been employed to encourage greater use of fertilizers, as for example in Denmark, fertilizer consumption has grown rapidly, simply because it paid. The result is a steep increase in the use of all fertilizers. In 1954–55, West Europe's consumption of phosphoric acid was 52 percent above the prewar level, of nitrogen 82 percent, and of potash 79 percent. Preliminary estimates for 1955–56 and forecasts for 1956–57 indicate that the increase has continued, though at a declining rate. With total agricultural land slightly below the prewar level, the quantities of fertilizers applied per acre have increased a little more than has total application.

Figures for actual fertilizer usage on different crops are highly uncertain, but information submitted to the OEEC indicates that row crops, fruits, and vegetables receive the heaviest application, grasslands the lightest. Grains claim roughly the same share of fertilizers as of agricultural land. There is no doubt that the use of fertilizers on grasslands is gaining ground increasingly as a link in the general effort to improve the productivity of grasslands. European experts feel that this practice still holds promise of great results, grasslands being especially responsive to greater use of phosphates.

Estimates of the quantitative effect upon output of the increase in fertilizer applications are subject to obvious weaknesses. Nevertheless, such estimates are being made and may be quoted as a rough indication of the magnitudes involved. The OEEC estimated that about one-half of the increase in West Europe's crop output in 1952–53 over prewar might be attributed to increased use of commercial fertilizers. Although this estimate seems too high, it is nevertheless

[5] Estimating the total nutrients supplied by commercial fertilizer and manure applications in 1947–50, the OEEC shows that the share of manure in the total ranged from 40 percent in the Benelux countries to 70 percent in Ireland.

beyond doubt that fertilizers have been the biggest single factor in the postwar expansion of crop production.

In view of the fact that total livestock numbers for the area as a whole are somewhat above their prewar level and that improvements have been made in collecting, storing, and distributing manure, it is apparent that there must have been an increase in the most recent years in the quantities of plant nutrients obtained from this source too. However, in Denmark, where comparative estimates are available, the increase is very modest, amounting to only 5 percent for phosphate and 3 percent for nitrogen; there was a 3-percent decline for potash.

Many soils in West Europe suffer from a lime deficiency, and, in several countries, notably the United Kingdom, aid is provided for the use of lime, with very beneficial results. It is difficult to give quantitative indications of the deficiency, since different soils have different optima and the requirements vary according to cropping pattern. Furthermore, figures for applications of lime are generally incomplete, and substantial quantities are added to the soils through marling or as a component in fertilizers.

However, such data as are available indicate that the lime deficiency is large. In West Germany, for example, it was estimated that only one-fourth of the annual requirements of CaO was supplied, and that on deficient soils crop yields could be increased substantially by adequate liming. For France the discrepancy between requirements and applications is even greater. In the opinion of specialists, in the early 1950's most countries failed to apply enough lime annually even to make up for annual losses. The conclusion was that if more farmers are instructed as to how, where, and how much to lime, especially if this instruction is coupled with aid for purchasing or spreading lime or both, substantial gains in crop yields can be realized.

Mechanization

Mechanization on West European farms as a whole lags behind that of the United States, owing to differences in relative costs of land, labor, and equipment as well as smallness and layout of farm units. There has nevertheless been rapid progress in the period under review, spurred on by a drastic decline in the farm labor force and rising wages.

While the war years in many countries meant a setback to mechanization, the United Kingdom saw a great expansion of the use of tractors and tractor-drawn equipment, and the expansion continued in the postwar period. Farmers in other countries also mechanized greatly in the postwar decade, especially in the 1950's. West Germany, for instance, had 139,000 tractors in 1950 and over 500,000 in 1957. France had 144,000 in 1950 and over 400,000 in 1956. Danish statistics

provide another example; for 1950 they showed that 83 percent of the farms with 66 percent of the land were unmechanized (i. e., neither owned nor rented tractors). In 1954 the share of unmechanized farms was down to 43 percent, with only 27 percent of the farmland; and tractor numbers have continued to increase rapidly.

It is customary to use the number of tractors as an indication of the degree of mechanization; sufficiently up-to-date figures for other equipment are not available for all the countries to permit other comparisons. Already before World War II, however, most of them used extensively not only horse-drawn machinery and equipment for cultivating and harvesting field crops, but also mechanical equipment in barn and stable for such purposes as threshing, feed preparation, and milk separating.

The number of tractors used on farms in West Europe in 1955 was 10 times the prewar figure, or 1.6 million compared with 160,000. All countries registered sharp increases. For the area as a whole there is one tractor for each 79 acres of arable land; the comparable figure for the United States is about 94 acres. Unfortunately, data are not available which permit comparison on the basis of horsepower, but there is no doubt that the average European tractor is smaller than the American.

In 1955, the United Kingdom had one tractor per 42 acres of arable land; at the opposite end of the scale, Ireland averaged one per 237

West Europe: Agricultural tractors,[1] *end year, by country, prewar, 1947, 1950, 1954, and 1955*

Country	Prewar [2]	1947	1950	1954	1955
	1,000 units	*1,000 units*	*1,000 units*	*1,000 units*	*1,000 units*
Austria [3]	1. 8	7. 8	14. 5	43. 2	57. 0
Belgium [4]	1. 4	2. 4	9. 4	22. 4	27. 2
Denmark	3. 5	4. 4	17. 2	50. 0	57. 8
France	36. 0	70. 0	144. 0	275. 0	330. 0
West Germany	[5] 30. 3	69. 0	139. 0	[6] 370. 7	460. 0
Ireland	2. 0	8. 6	13. 0	25. 9	28. 7
Netherlands	4. 0	7. 0	18. 4	31. 0	36. 0
Norway	2. 8	6. 8	10. 9	29. 5	35. 0
Sweden	22. 6	31. 9	63. 8	100. 0	110. 0
Switzerland	4. 9	7. 0	13. 1	22. 0	24. 2
United Kingdom [7]	50. 0	224. 3	325. 0	415. 0	430. 0
The area	159. 3	439. 2	768. 3	1, 384. 7	1, 595. 9
1938=100	100. 0	275. 7	482. 3	869. 2	1, 001. 8

[1] Excluding horticultural tractors.
[2] Mostly 1938.
[3] Including forestry tractors.
[4] Including Luxembourg.
[5] Farmer-owned tractors, including motor-mowers and rotary tillers.
[6] Tractors of agricultural, forestry, fishing and dairy enterprises.
[7] Up to 1952, figures include all tracklayers over 6 h. p. and all 3- and 4-wheeled tractors. Thereafter figures include, for Great Britain, all tractors of 10 h. p. and over, and, for Northern Ireland, tracklayers of more than 6 h. p. and all 3- and 4-wheeled tractors.

OEEC, "Agricultural and Food Statistics," Paris 1956.

acres. Thus, though the number of tractors in relation to arable land in West Europe would seem adequate, there is great regional inequality. France, for instance, could no doubt utilize far more tractors, whereas countries such as the United Kingdom, West Germany, and Switzerland appear amply supplied in relation to the number of farms which can make sufficiently good use of tractors. Of the more than 8 million farms and small holdings in West Europe, one-half, or a little more, are less than 5 hectares (about 12.5 acres) in size and many are too small for mechanized operation.

Particular attention has been given in recent years to solving the technical and economic problems of mechanization on farms in the critical size-group 5–10 hectares (12.5–25.0 acres). The problem is complicated by the fact that in many parts of the area, for instance, southern Germany and Belgium, such small farms frequently consist of a great number of parcels of land scattered over a wide area. Thus, farmers often must travel great distances to their fields from the villages where the homesteads are located, and from field to field.

While consolidation of land, the ultimate solution, is gaining greater momentum, it is a slow and difficult process. In the meantime mechanization on small and fragmented farms is being furthered by construction of equipment of a size and type suited to these farms. West Germany, especially, has a large production of small tractors. Joint ownership or use of machinery is also practiced in places. Sometimes two or more farmers own equipment jointly, or a farmer rents his equipment to neighbors.

West Europe: Horse numbers, by country, average 1934–38, and selected years 1947–55 [1]

Country	Month of estimates	Average 1934–38	1947	1950	1954	1955
		1,000 head	*1,000 head*	*1,000 head*	*1,000 head*	*1,000 head*
Austria	Dec. 3	[2] [3] 261	[4] 283	283	245	235
Belgium	Jan. 1	245	281	247	193	185
Denmark	July 15	553	574	465	308	281
France	Oct. 1	2, 808	2, 407	2, 397	2, 215	2, 161
West Germany	Dec. 3	[5] 1, 542	1, 577	1, 570	1, 172	1, 098
Ireland	June	429	421	367	296	276
Netherlands	May	293	300	270	222	208
Norway	June 20	186	206	184	150	142
Sweden	Summer	615	497	415	312	284
Switzerland	April	[2] 140	142	131	120	117
United Kingdom	June	1, 107	703	478	[6] 310	[6] 290
The area		8, 179	7, 391	6, 807	5, 543	5, 277

[1] Years beginning Oct. 1.
[2] Census or estimate for single year.
[3] March.
[4] November.
[5] Average 1935-38.
[6] Partly estimated.

Based on official sources.

Machine cooperatives have been developed on a significant scale in the United Kingdom, Sweden, and Denmark. In West Germany special credits are granted for the purchase of farm machinery on a cooperative basis. Freedom from taxes on fuel, complete or partial, encourages the use of tractors on all farms in several countries. France has also given rebates on agricultural machinery. In many countries, instruction is given in machine usage and maintenance, and government-supported machine stations test equipment and conduct research in the technical and economic aspects of mechanization.

It has been questioned whether mechanization on small farms in some West European countries has already gone too far, whether tractors have been introduced for reasons of prestige or by miscalculation on farms too small to make profitable use of them. In West Germany, for example, where 60 percent of all draft power is mechanized, statistics show that most recent tractor purchases have been made by farms of less than 25 acres, and many of less than 12 acres.

A number of studies have investigated the cost of tractor operation compared with that of animal draft power under various circumstances. Though introduction of a tractor on a farm generally causes changes in production pattern and intensity, so that the economy of such substitution is a complex problem, these comparisons nevertheless shed light on the question of the economic limits for tractor utilization. The results of a Danish and an Austrian study may be described.

The Danish investigation calculates the economy of mechanization on the basis of accounts kept for the 5 years 1949/50–1953/54 by 17 farms ranging in size from 35 to 125 acres. The result is as follows:

	Annual average per tractor (In kroner)[1]	
	1949/50–51/52	*1952/53–53/54*
Cost of mechanization	4,072	5,267
Saving in cost of horses	3,260	3,245
Saving in cost of labor	1,734	3,142
Net saving per tractor	922	1,120

[1] One krone=14 cents.

In addition to the direct saving, the accounts showed some shifts to more labor-intensive crops, presumably resulting in greater gross output per farm.

The Austrian study stresses the fact that profitable substitution is not strictly related to size of farm or the number of hours that the tractor is used, but to the relationship between the cost of horsepower and tractor power under the specific circumstances. It is emphasized that the annual cost of a team of horses is a fixed cost to a far greater extent than that of a tractor, since the only important variable cost item, feed, can be reduced only by some 20–25 percent if the horse is idle. A team of horses not fully utilized is, therefore, more uneconomical than a tractor not fully utilized, a situation which is common on

12- to 35-acre holdings. It shows, on the basis of Austrian costs, that, on the average, holdings of from 15 to 50 acres can substitute the 15-horsepower tractor for two horses with profit, and the smaller the holding the greater the profit, since the two horses would be less fully utilized. The cost of operating one tractor, however, exceeds that of using one horse.

Stating that the predominant number of farms over 8 hectares have two horses or more, the study concludes that these farms, if the capital is available, stand to gain by acquiring a tractor, assuming they give up both horses. The same is true of the fairly substantial number of farms of 12 to 20 acres which employ two horses. Furthermore, some farms with one horse can intensify production sufficiently by acquiring a tractor to make the shift profitable. The limiting factor to mechanization of small farms with one or two horses is often lack of capital.

While larger farms may be able to use various combinations of tractor and animal draft power to advantage, for the smaller farms discussed above full mechanization is essential for economy. But in view of the fact that tractor fuel in West Europe is largely imported and may be unobtainable in an emergency situation, it is not surprising that farmers as well as the authorities sometimes are reluctant to see horse numbers reduced to the levels that considerations of economy may suggest. For the area as a whole the number of horses has declined by 2.9 million from nearly 8.2 million before the war to about 5.3 million in 1955–56, or by two horses for each tractor put into use.

The combine is making its appearance in increasing numbers in West Europe, although the total is still rather modest. In some countries, combines account for a significant share of the grain acreage harvested. Sweden, with its high wage rates and highly developed farm mechanization, has one combine for about 200 acres of grain land. But France, West Europe's largest wheat producer, has only one combine for about 1,550 acres. In the United States the corresponding figure is about 120 acres. High humidity at harvesttime makes artificial drying of grain necessary in many places when the grain is harvested by combine. But the possibility of more timely harvesting if a combine is available gives this equipment great importance.

In view of the general importance of dairying in West Europe, the increased use of milking machines is significant. For Sweden, Denmark, and England and Wales it is estimated that 80 percent or more of all cows are milked by machine. But again there are great regional differences. France, with over 9 million cows, has only 71,000 milking machines.

Partly as a result of rural electrification programs, electricity has become available on most farms in most countries. In France the proportion of rural homes with electricity increased from 82 percent in

1946 to 89 percent in 1954. In Sweden 95 percent of the farms had electricity in the early 1950's, compared with 70 percent in 1944. West Germany reported that 92 percent of all farms were equipped with electricity in 1949. Smaller countries, such as Belgium and the Netherlands, have electricity on nearly all farms. The United Kingdom lags in this respect. In England and Wales the number of farms with buildings connected to the public electricity system increased from 85,000 in March 1948 to 172,500 in March 1956, but still amounted to little more than 63 percent of all farms with buildings.

Consumption of electricity has increased strikingly. On West German farms, for example, it rose by more than 50 percent between 1949 and 1954. In rural areas in France, it nearly doubled between 1949 and 1955, and on farms in England and Wales, it more than tripled between 1948 and 1955. Consumption per farm with electricity in England and Wales, which is far higher than in West Germany or France, increased by 66 percent in 7 years.

Household use probably accounts for most of the increase in consumption in West Europe, as in the United States. Nevertheless, the use of electricity has been spreading not only as a source of power for milking machines, threshers, water pumps, and so forth, but also as a source of heat for drying grains or grass, for incubators, and occasionally for heating pens for suckling pigs, and even beehives. Electric fences are an important aid where rotational grazing is practiced. England and Wales, for example, had nearly 90,000 electric fencing units in 1954.

Extension of piped water supplies to more and more farms, again partly under government programs, has also been of substantial aid in modernizing farm activities. Only one-third of the rural population in France had piped water in 1949, but some two-fifths in 1954. One-half of all Danish farms had piped water installations in 1950, compared with one-fourth in 1944. In Sweden, 48 percent of the farmhouses and 55 percent of the stables had water by 1951. In West Germany in 1949, one-half of the farms were connected with public water systems and another 14 percent had their own piped water installations. By 1956, over 70 percent of the rural population of England and Wales had piped water or were within easy reach of water mains.

Plant Breeding

Scientific work in the field of plant breeding is of long standing in West Europe. Institutions such as Svalöf in Sweden, Rothamsted in the United Kingdom, the Kaiser-Wilhelm-Institut für Züchtungsforschung in Germany,[6] the French research center at Versailles, and

[6] After World War II an Institute for Plant and Seed Production was established as a part of the research center at Braunschweig-Völkenrode.

the Dutch center at Wageningen have done work of international repute in this field for decades. While grains received the greatest attention originally and continue to be the object of intensive research, potatoes, grasses, leguminous plants, oilseeds, and fruits and vegetables have been added to the list of crops worked with. Much of the work has been done by private plant breeders; much has received government support.

The development of higher-yielding varieties has always been high among the plant breeders' goals. Thus, the latest most spectacular crop increase—that of wheat in postwar France—is attributed in large measure to the expanded usage in central and southern France of a relatively new, high-yielding variety, the "Etoile de Choisy." Introduction of American hybrid corn in Europe after the war—after extensive testing to determine which types were adaptable to conditions in the various countries—led to greatly increased yields. France in 1954 had 31 percent of its corn acreage in hybrids. (Corn is, of course, of comparatively small importance in West Europe as either grain or green feed.)

Resistance to disease and pests has also been a characteristic of continued importance to breeders, though in northern Europe perhaps overshadowed in importance by resistance to cold. In the United Kingdom, plant breeders have devoted much effort in recent years to stiff-straw varieties which can take heavy use of fertilizers. In bread grains, baking quality has been the object of special attention; in barley, malting quality. With the increased use of combines, development of grain varieties subject to smaller loss when harvested by combines has occupied British plant breeders and is now also receiving attention in other countries, such as Sweden. Similarly, lifting of root crops by machine has created new criteria for desirable root surfaces. Maintenance of research in oilseeds—although oilseed production had been abandoned in the interwar period for all practical purposes—made it possible for Sweden to increase this crop after World War II to very important proportions. The list of significant contributions by plant breeders could be extended very considerably.

Contacts between plant breeders on the international level have been intensified in recent years, and in 1956 at Wageningen a European Association for Scientific Research on Plant Breeding was set up to coordinate plant breeding work on a European basis. Through a division of labor, mutual assistance in scientific research, and exchange of plant material it is expected that quicker and better results can be obtained than heretofore.

Essential as is plant breeding, its contribution to crop output depends on testing and multiplication of the seed of the new varieties, on seed certification procedures, on protection of breeders' rights,

and, last but not least, on the farmer's knowledge of new plant material and his willingness to purchase the seed. Conditions differ greatly from country to country in these respects, but recent intensification of inter-European collaboration holds much promise of further increasing the effectiveness of the plant-breeding work.

OEEC has devoted considerable effort to this subject. Thus in 1952 an OEEC Mission of Experts made the first comprehensive survey of seed production, testing, and distribution in member countries. This was followed by a conference in Stockholm on seed production and seed trade, with the object of discussing the recommendations of the Mission and bringing them to the attention of all concerned.

The findings and recommendations resulting from this work indicate that there is a good legal and administrative framework in most West European countries on which to base a more efficient system of certification, testing, and distribution of seeds. Practically all countries have legislation, more or less extensive, concerning production and sale of seeds. Generally, seed offered for sale must be up to certain standards. In France, West Germany, and the Low Countries, official lists of varieties which may be sold to the public are published annually, and in these countries only such varieties can be imported. In England, the National Institute of Agricultural Botany issues lists of recommended varieties of grain. Most West European countries are members of the International Seed Testing Association. International seed analysis certificates, based on the rules of this organization, are being used in many countries by the seed trade for seeds that enter international trade. It is felt that if the same standards were used in setting national rules for trade in seeds, the results would be very beneficial.

Certification standards (and the crops to which they are applied) vary from country to country. Certification may be by official bodies and compulsory for all seed or may be unofficial, undertaken by private breeders. Grains and potatoes are the principal crops to which certification is applied, but some countries include root, forage, and herbage seeds. Since the nomenclature also varies, it is often difficult to compare certification standards. Varieties eligible for certification in a particular country are subject to thorough testing in field performance trials.

The Seed Mission's work resulted in a series of recommendations to individual countries, varying in accordance with existing conditions and designed to further improve existing breeding work as well as regulations and control procedures. As matters of general interest to all countries, it was suggested that international variety trials be organized by the OEEC for crops for which this had not been done already; that these trials aim mainly at testing varieties used as "controls"; and that information concerning the trials be published regularly. It was further recommended that countries not

yet issuing lists of recommended varieties should give high priority to establishment of an officially recognized list. Thereupon, it would be possible to establish an international list.

The establishment of a European crop improvement association to deal with seed certification problems and procedures was also recommended.

In order to get farmers to avail themselves of the benefits of tightened standards for seed testing and certification as well as of acceleration of breeding work, the cooperation of the advisory services—as well as the use of other means of information—is of prime importance. Considering that, with the exception of the United Kingdom and the Netherlands, most West European countries in 1951 reported percentages generally below 30 for the share of seed used that consisted of tested seeds of improved varieties, great gains in productivity appear possible from widespread use of better seed. It is an especially promising endeavor, not least for the numerous small farmers, since the use of high-quality seed is one way of increasing output without spending much capital.

Control of Plant Diseases and Pests

In West Europe, as in the United States, the last two decades have been a period of startling new developments in the field of chemical control of crop pests and disease. During the war, new chemical crop-protection means were developed which supplemented or replaced those formerly in use. The discovery of DDT in Switzerland and benzene hexachloride (BHC) in France made possible products which could be used as both contact and stomach insecticides. Similar discoveries were made by the chemical industry of the United Kingdom, including the development of selective weedkillers such as 2,4-D. From Germany came phosphoric insecticides and miticides, including systemic products. Organo-sulfur products constituted new fungicides. Simultaneous development of new pesticides in several countries inside and outside Europe characterized this period.

The arrival of new and effective products has of course in no way lessened the interest in other means of pest control, such as crop rotation and other cultural practices as well as the development of resistant crop varieties, though in some areas the use of weedkillers has reduced the need for root crops in the rotation to clean the fields. There are still many pests of great economic importance to West European agriculture for which effective chemical control is not now available—most of the nematodes, for example. But the chemicals have become supplements of ever-increasing importance to other preventive measures and are being applied with great savings in crops.

To give an indication of the importance of pest control, some estimates of losses due to pests in certain West European countries may

be quoted. For the United Kingdom especially, interesting figures have been published.[7] The estimated losses, which are calculated on the basis of 1947 conditions, are expressed in terms of value as well as in terms of the acreage "unharvested" because crops did not materialize owing to attacks of diseases and pests. The loss is also expressed in terms of labor wasted.

In terms of value, the losses in a year's crop were estimated at £78 million, or about one-eighth of the income produced in agriculture, while the cost of those control measures which had been taken came to some £10 million. Diseases of potatoes—blight, rot, virus, eelworm, and haulm-burning are listed—were by far the biggest cause of loss, amounting to nearly £12 million, although over £3 million had been spent on their control. Losses to the hay crop due to weeds and rabbits were second in value and first in terms of acreage "unharvested." But losses to the grain crop caused by fungi and insect pests, and to the crops of turnips and swedes (flea beetle, crown rot), were almost equally large in monetary terms. They were followed closely by the losses from scab and brown rot on apples, despite the fact that a third of the cost of all control measures was expended on apples to combat these diseases.

The acreage considered unharvested in these calculations came to a total of 1.9 million acres. Measured against the land in farms and the number of workers on farms, estimated losses due to disease and pests in 1947 corresponded to the crop production of 33,000 average farms and 51,000 workers.

Measures of control have improved significantly since 1947. By 1951 the author estimated that the cost of control measures actually effected would be perhaps 25 percent higher and the losses actually suffered perhaps 7–9 percent smaller than in 1947.

In France, it is stated that actual production in the early 1950's was perhaps reduced by some 18 percent owing to losses caused by pests. Figures for Belgium put the loss for grain at over 5 percent of the acreage, and for total crop production at 10 percent. A German calculation of 1954–55 gives the startling conclusion that over 25 percent of the "obtainable" crop is lost through disease and pests.

Many data are available, for instance from West Germany, as to the profitability of the use of pesticides, indicating very favorable results in general. That these products are not more universally applied stems from a variety of causes—among them, inertia and lack of knowledge of this complex subject. But the fact remains that in specific cases there are many uncertainties; for example, about whether the trouble will in fact occur or to what extent. Also, pest control must compete with other farm activities for labor and capital.

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[7] George Ordish, *Untaken Harvest, London,* 1952.

Efforts to make maximum use of available knowledge and materials concerning pest control take several forms. Research devoted to the development of chemical agents, as well as implements for their application at the lowest possible cost in relation to the value of the crop saved, is a continuing effort of basic importance. But, in addition, measures taken by official or semiofficial agencies are essential and include testing of materials, warning of appearance or approach of disease or pests, dissemination of knowledge of pest control through advisory services or other media, and international action.

The importance of some control or regulatory specifications for pesticides offered for sale is obvious; they are in the interest of farmers as well as consumers of food. For this and other reasons, governments generally take a hand in appraising these products and setting conditions of their distribution.

In France a law was enacted in 1943 under which a Crop Protection Products Commission and a Study Committee were set up. The Commission was entrusted with the task of establishing standards for the official approval of pest control products. The Study Committee must see to it that the necessary tests are carried out and the sale of the products is properly authorized. When a product is submitted for approval and has been authorized for sale after exhaustive tests, the manufacturer receives a notice stating (1) the chemical composition of the product, (2) its use in plant protection, (3) method of application, (4) approved dosage, and (5) the pests affected. This information must be given on all labels and in commercial literature. The system is considered highly effective, not only as a means of checking undesirable products, but because of the guidance it provides the farmers. It is also said to have led to much fruitful government-industry cooperation, resulting in new and beneficial methods of pest control. This approval is required for all fungicides, products to control pests, and weedkillers.

In West Germany it is a function of the Federal Plant Protection Service to test and approve pesticides and equipment for their use, while the research work is carried out at the Federal Biological Institute. Other countries have similar institutions and procedures.

Since the effectiveness of certain types of pest control depends on proper timing, it has been found expedient to advise farmers when to take action concerning these pests. Therefore, several countries have established a warning service.

The French example, which appears to be especially well developed, may again be quoted. It is concerned mainly with pests on vines, fruit trees, potatoes, rape, beetroots, hops, and olives. The country is divided into 12 regions, each having a warning station consisting of a laboratory, a meteorological station, and an administrative office. Extensive records of crop development, weather conditions, and pest

development are made regularly. On the basis of this information the time for treatment of the pests in question is determined. This information is disseminated by way of the radio, the press, and subscription. It has been found that the warning system not only saves crops, but reduces the number of pesticide treatments formerly considered a necessary precaution.

In matters of pest control it has been emphasized repeatedly in recent years that the work of the advisory services is of especial value in helping the farmer appreciate and avail himself of the products and procedures known and obtainable. Practically all countries have some advisers who are specialists in plant protection, but usually the general extension agents must be responsible for the information reaching the farmer. There appears to be a general feeling that strengthening of such services would be highly worthwhile.

The problem of pest control lends itself well to international action, which in fact is essential to the solution of some problems. The establishment of the European Plant Protection Organization (EPPO) in 1951 exemplifies this. This organization grew out of efforts made around 1947 to prevent the threatening spread of the Colorado beetle to those European countries which were then free of this pest. Concerted action through an International Colorado Beetle Committee stopped the beetle from spreading. This success led to the establishment of the EPPO, with a scope extended to cover other pests and diseases of international importance. Collaboration through the OEEC, providing a training course and exchange of information, is another example of productive cooperation in this field.

Grassland Management

Among postwar West European agricultural problems, few have received as much attention as that of grassland management. Since grasslands occupy an average of 60 percent of the agricultural land of the area, it is clear that increased output from this land can contribute greatly to the economy of the individual farm enterprise. Furthermore, since grasslands also provide about 60 precent of all feeds while imported feeds supply some 7–8 percent, increased output of grass, hay, and silage can considerably reduce this dependence on feed imports. The importance of this aspect was placed in the foreground in the early postwar years when efforts to save foreign exchange were especially vital. That West Europe's gross livestock production in 1955–56 was 22 percent over the prewar level while feed imports were 12 percent below prewar is in no small measure attributable to better utilization of the extensive grasslands.

The term grassland covers land of widely varying productivity, ranging from the meager so-called rough grazings over the more productive permanent grasslands to the very high-yielding intensively

cared-for temporary leys.[8] Some permanent grasslands, such as those in the western part of the Netherlands, are also of high quality but in general the yields of the grasslands are greatly increased when they occur as leys in the crop rotation, subject to the same intensive and well-planned care as other arable crops. In Denmark, for instance, the yield per acre of hay from rotation grasses is normally almost 50 percent greater than the yield of meadow hay. In addition, the soil-building qualities of a good ley benefit future crops.

Efforts to improve the output of feed from grasslands in postwar West Europe have taken a number of forms, including (1) further shift from permanent to temporary grass; (2) developing better strains of grasses and leguminous plants, and better practices in respect to production and distribution of seeds; (3) finding more appropriate seed mixtures; (4) greater use of fertilizers and lime; (5) better utilization of the crop; and (6) more demonstrations and other advisory services.

While grassland in the rotation is nothing new in West Europe, agricultural land-use figures indicate increased emphasis on this practice. Figures for 1952–55 show a decrease in permanent grassland and rough grazings of 4½ million acres, or 4 percent, compared with prewar, while temporary grasslands increased almost as much. The United Kingdom accounts for most of this shift and here, it is stated, the output of grass has increased at a yearly rate of 2 percent over the 15-year period 1940–55.

With the increase in temporary leys the question of the proper seed mixture is of growing importance because of the need to provide a succession of grasses through a long season, preferably extending through the winter when possible, and through the 1 to 4 years planned for the ley. Considerable advances have been made in this respect in the United Kingdom and elsewhere. While a mixture of certain strains of ryegrass and white clover is excellent in the humid areas, orchard grass, timothy, and meadow fescue produce a better ley in the drier region in the east of the country. Alfalfa has found increasing favor, with a French strain gaining popularity in neighboring countries. As mentioned above, plant breeding and multiplication and certification of seed, including herbage seed, has received much attention.

There has been a growing realization among farmers in West Europe—due to the emphasis placed on the subject by agronomists and advisors—of the fact that grass responds to generous fertilizer applications. In the temperate, humid climate of northwestern Europe, soils are to a large extent highly leached, acid, and low in phosphorus. Liming is therefore important, as is the application of

[8] Leys are grasslands in the rotation—mixtures of grasses and clovers sown down for 2, 3, or 4 years.

commercial fertilizer. How much fertilizer is actually used on grasslands is not known but specialists feel that, despite recent progress in most countries, only a fraction of what could be used to advantage is being applied.

Research and experimentation have also established a number of facts about the time when the nutritive value of grasses and legumes is highest, and this has led to specific recommendations about the timing of grazing or cutting the grass, or both, for hay or silage, as well as rest periods for regrowth. Thus, the practice of earlier cutting of hay is on the increase to produce hay of higher protein content and greater digestibility than the hay produced by the later harvesting formerly practiced. Also, alternate mowing and grazing has been found a system that utilizes the grass to better advantage than the system which draws a line between mowed and pastured grassland. This implies controlled grazing, in contrast to free grazing, a practice which has been made easier by the introduction of electric fences which can be easily moved about to permit grazing, resting, or cutting of the various parts of the grassland as desired.

Curing of hay on the ground is still common practice in many areas, but research has shown conclusively that the loss of nutrients during curing is smaller when hay is dried on tripods or similar devices, and this practice is gaining ground, though hampered by the fact that it requires more labor. Artificial drying of grass has also been introduced, but is fairly costly.

Silaging of grass made great strides during and after World War II. In the United Kingdom especially, trench silos are widely used for the purpose, but concrete or wood silos have also appeared in considerable numbers in most countries. In Denmark, for instance, the number of farms which had silos in 1954 was 92,000, compared with 26,000 in 1945. They are, however, used for silaging of other feeds, especially root tops, as well as grass. Silaging of grass conserves the nutrients of the grass much better even than tripod drying, and does away with the problem of drying the hay in the humid climate that prevails over much of the West Europe. Owing to the low carbohydrate content of the feedstuffs silaged in northwestern Europe, it is sometimes found expedient to use additions of a chemical solution, the so-called AIV method of silage making, named for its Finnish discoverer A. I. Virtanen.

Calculations of the amount of feed that could be obtained if better grassland management practices were more generally adopted may give the impression that imports of feed into West Europe could be dispensed with. This is very unlikely. Apart from inertia and the impossibility of providing every farmer with complete information on his specific situation, it is not always possible, in view of the limitations of land, labor, and capital, for each farm to devote the

necessary resources to an ideal program for grassland development. Furthermore, purchased feeds permit a desirable flexibility, in expanding and contracting livestock activities in line with price changes. They also provide the opportunity to get that level of production on each farm which is most advantageous in view of prevailing price relationships between feeds and livestock products. They permit the many small farmers to carry on a level of livestock production, essential for their existence, beyond the limits set by their own feed production. Also, it is easier to calculate proper feeding rations on the basis of purchased feed than on the basis of the more variable domestically produced roughage.

Livestock Breeding

Artificial insemination of *cattle* has become common practice in West Europe since 1945. Begun in the 1930's on a small scale in some countries, such as Denmark and the Netherlands, it was seized upon after the war as an aid in rebuilding herds of healthy stock. The United Kingdom set up the first trial centers in 1942.

The extent to which artificial insemination is now utilized varies considerably from one country to another. Where farmers are used to organizing for common purposes, there is better basis for introducing such a practice than where farmers are not so organized. Geographical conditions can help or hinder its adoption.

In 1954, Denmark reported that 91 percent of its cow population belonged to members of cattle breeding associations which used artificial insemination. The percentages during the 2 preceding years had been 81 and 70, respectively. In England and Wales officially licensed artificial insemination centers are found throughout the country, and were used by 60 percent of the herds in 1955. Since the use of artificial insemination is most widespread in smaller herds, this corresponded to some 47 percent of all cows. The Netherlands in 1955 showed 45 percent of all cows as artificially inseminated. In Sweden the corresponding percentage in 1954 was 28; in Norway only 10. It was also 10 in West Germany at the end of 1952, but has probably increased since then. Concern about inbreeding is allegedly in part responsible for the low German percentage. In France over 1 million cows were bred at artificial insemination centers in 1954, about 12 percent of all cows.

Wider use of the best bulls, made possible by artificial insemination, is credited with a considerable share of that improvement of dairy breeds which has taken place in recent years, resulting in higher milk yields per cow. In Denmark, artificial insemination has led to a basic change in bull progeny testing. Until 1945 all evaluation of the breeding value of bulls, so far as milk yields of progeny are concerned, was based on daughter-dam comparisons. Now the bull progeny testing stations assess the value of the bull by comparing the

milk yield of his daughters with that of contemporary groups of cows sired by other bulls. This system is being employed to some extent in other countries, too.

Among new trends in the aims of cattle breeding is the practice begun in the United Kingdom of artificially inseminating the lower-yielding dairy cows with semen of bulls of meat breeds. The resulting calves, unlikely in any case to be kept in the dairy herd, will thus produce more or better meat or both. This system has also been practiced to some extent in Norway and Sweden, using Hereford and Aberdeen-Angus with domestic dairy breeds. The shortage of labor in these and other countries which formerly concentrated practically all their efforts on dairy cattle has led in recent years to increased interest in beef cattle or cross-breeding with beef cattle. The United Kingdom, on the other hand, long famed for its beef cattle, has placed more emphasis on breeding of dairy cattle. Frisian-type dairy cattle now account for over 40 percent of all cattle in that country. In France the artificial insemination centers are reportedly emphasizing milk production in their improvement program.

Hog breeding has been influenced by a shift in consumer demand to leaner pork. Consequently, countries that once preferred heavier hogs have recently placed more emphasis on developing the leaner bacon-type, of which the Danish Landrace is an outstanding example. Systematic breeding and selection with a view to bacon-type qualities (and of course to favorable feed conversion) have, therefore, received increased attention. At the German Max-Planck Institute for animal breeding and animal nutrition, crossing of the German improved Land Swine with Danish hogs for the purpose of producing a German bacon hog became a primary aim of the work with hogs in the 1950's.

The United Kingdom since the war has instituted progeny testing for hogs such as has long been practiced in Denmark and the Netherlands. In 1956 a National Pig Testing Board was established, which will devote its efforts to testing pedigree boars through testing litter groups sired by the boar. The feeling in Britain is that, with artificial insemination of hogs becoming technically practical, hog breeding work will be greatly improved.

Poultry breeding in Europe in the past aimed almost exclusively at high egg production. Specialized production of table poultry is a relative newcomer there. The highest average egg yields per hen—205 in 1954—are obtained in the Netherlands, which also shows a great increase in yields per hen during the last decade. The increase in yields is attributed in considerable measure to new breeding practices.

It is quite generally true that poultry is recognized as an important branch of farming now, far more than before the war, when it was largely considered a sideline to other farm activities. Poultry breed-

ing is therefore also receiving more attention. The Dutch system, for example, is especially interesting.

Some 10 years ago, Dutch farmers relied almost exclusively on pure breeds, primarily white leghorns, but also Rhode Island reds, brown leghorns, and barnevelders. But in 1956 no less than 80 percent of Dutch chickens were reported to be crosses. This development started spontaneously on a few farms, and was later made the object of governmentally supported research and experimentation. This showed conclusively the superiority of the crosses over the pure breeds, in egg production as well as general vitality.

Since 1933 the Netherlands has had a poultry farm system organized as follows: (1) Breeding farms (some 200), (2) farms producing hatching eggs (about 4,000), (3) recognized hatcheries (about 700), and (4) commercial poultry farms. The farms producing hatchery eggs acquire their poultry stock from the breeding farms and sell their eggs to the hatcheries. From the hatcheries the farmer who produces eggs for the market gets his chicks. Under this system the breeding farms provide pure breeds to the producers of hatching eggs. This is where the breeds are crossed. Since hatcheries must obtain their eggs from these farms, it will be seen that once crosses were found desirable, the changeover from pure breeds to crosses could be carried out relatively quickly.

Livestock Feeding

Feed is the predominant item in the cost of producing livestock products. In the United Kingdom, for instance, it accounts for some 60 to 80 percent of the total cost. To improve the economy of livestock enterprises, all West European countries are, therefore, devoting much effort to reducing the cost of feeds and feeding. The problem is being approached from many angles, such as increasing the supply of the more inexpensive home-grown feeds and increasing its nutritive content through improved feed-processing methods. Feeding methods and other aspects of livestock care that contribute to more efficient feed conversion are also being studied and improved to better the feed economy.

The most important single item in West Europe's feed supply is grass, or rather the herbage crops of the grasslands. Improvements in the utilization of this source of feed have been discussed. These efforts aim at increased quantity and quality of pasture as well as of the hay, dried grass, and silage produced.

Silage production was of little importance in West Europe in the 1930's, but gained ground during the war and postwar years. The advantages of silaging grass compared with producing hay have been mentioned: Less loss of nutrients and independence of weather conditions. Furthermore, silagemaking lends itself to mechanization and

does not cause the heavy concentration of labor requirements that haymaking calls for. But silage is a highly variable product, and much experimentation is needed to determine its proper preparation and usage. The use of silage may affect certain qualities of the final product, favorably or unfavorably. Thus, for example, for dairy products, Dutch experiments record improved quality of the winter milk when silage is used in the place of hay, specifically greater vitamin A content and better color and spreadability of the butterfat. A Danish writer, on the other hand, points out problems of butter quality (taste) in regions where silage is used most extensively.

Silaging makes it possible to utilize certain crops to advantage that once were not fed at all. Thus, silaged root tops provide a good winter feed of relatively high protein content in Denmark; formerly only a small part of the tops could be fed in fresh condition, while the remainder was plowed under. Cooked potatoes in silaged form have proved—in experiments and practice, especially in West Germany—an excellent feed for hogs and are being utilized extensively in those countries which produce a surplus of potatoes for feed. Norwegian experiments indicate that cooked potatoes can provide as much as 60 percent of the feed required in fattening bacon pigs. Protein supplements must be used, and fish meals have found a place here, though other animal or vegetable proteins are used as potato supplements, too. Experiments with raw silaged potatoes in France, the Netherlands, and Norway all show that this feed is inferior to silage made from cooked potatoes. While sugar beets silaged alone have not proved a good feed, a ratio of 1 : 1 or 1 : 2 of sugar beets and cooked potatoes has been found good in Germany and Switzerland.

Grains cut green are also used in making silage. This can be of special significance in areas—for instance, in the far north—where it is uncertain whether the grain will mature. Because of its value when silaged, corn has been grown to some extent in recent years in northwestern Europe, in areas where it cannot be expected to ripen.

A very important addition to the feed supply available for livestock production in postwar years is the feed which, were it not for mechanization, would have to be used as feed for draft animals. The number of horses in 1955–56 was almost 3 million less than before the war. The feed that would be required for such a number would amount to roughly 6 million tons of grain or its equivalent in other feeds.

Important as the greater availability of domestic feeds has been for the West European livestock economy, efficiency in the utilization of feeds has been hardly less important. Increased knowledge of the most advantageous composition of the feed ration, including the addition of vitamins and minerals, the use of antibiotics and hormones in animal nutrition, and the application of this knowledge on the farm, has contributed significantly to increased livestock production

per unit of feed input. The importance for efficient feed utilization of proper housing of livestock is recognized, though the desirable building improvements can be made only slowly.

The shift in pork production from fat to leaner products has also meant economy in the utilization of feed; fat production requires larger feed input per weight unit of output than does meat. The net result of the various trends that affect the feeding efficiency of hogs in West Europe, according to German estimates, is that a given quantity of feed grains now will produce a 10-percent greater quantity of pork than in the mid-1930's—an annual rate of increase in the efficiency of feed utilization by one-half percent. It is also estimated by the same German source that between 1934–38 and 1954 the amount of feed grain available for livestock production in West Europe [9] increased by 0.6 percent annually, while production of pork rose by 1.17 percent, and production of eggs by 0.74 percent, pointing to better feed conversion.

Improved feeding efficiency is the subject of continued intensive research and experimentation. Equally important are efforts to apply the findings at the farm level. Figures available from farms which keep detailed accounts indicate great variations in the amount of feeds consumed per unit of livestock product on different farms; often a more general adoption of those feeding practices that the most successful farmers follow would result in substantial feed economies. A new approach to this problem is reported from Denmark, where farmers in 1954 began establishing Hog Feed Recording Associations. Such an association—consisting of about 25 members—employs a qualified supervisor who visits each farm twice a month, maintains records of the weights of each hog, and sets up a rational feeding plan for each animal. Records and feeding instructions are posted over each pen to facilitate proper feeding. Though rather expensive, these associations appear successful and worth the cost.

Control of Livestock Diseases

The subject of animal health and control of animal diseases in West Europe has in recent years been taken up at the international level through the efforts, especially, of the Working Party on Animal Health of the OEEC. A survey was made in 1952 of the control of livestock diseases in the member countries, indicating which diseases are of importance, as well as the organization of veterinary services and special programs to control specific diseases. It was estimated that losses due to animal diseases in member countries were on the order of 15 percent of the value of output of livestock products.

Five diseases were given special attention as being of primary importance: Bovine tuberculosis, brucellosis, bovine mastitis, foot-

[9] Including Mediterranean countries.

and-mouth disease, and swine fever. Newcastle disease in poultry was later added to the list. In 1954 the following four diseases were taken up for study: Warble fly infestation in cattle, coccidiosis in poultry, Teschen disease in pigs, and infections associated with infertility in cattle. Every country in West Europe has legal provisions which aim at preventing the introduction of diseases from other countries, and most countries have programs, more or less extensive, aimed at preventing or controlling the most troublesome diseases.

Bovine tuberculosis has been a serious disease in the past, but is steadily diminishing in occurrence owing to action programs in individual countries. Thus, the Netherlands and the Scandinavian countries have succeeded in almost completely eradicating this disease in recent years. In the United Kingdom and West Germany, measures of control are showing very good results. In 1956 the United Kingdom reported 67 percent of all cattle in "attested areas," i. e., in areas free from tuberculosis, or in attested herds. The percentage was 60 a year earlier. The cows included produced 75 percent of the milk sold off farms in 1956. In West Germany the percentage of cattle herds officially recognized as free of tuberculosis increased from 10 in 1952 to 36 in 1955. In the latter year, 59 percent of the herds (61 percent of the cattle) were taking part in the West German eradication program. Belgium in 1956 reported that 82 percent of the farms over 1 hectare were taking part in control measures against tuberculosis. Infected animals were said to number 10.5 percent of the cattle in 1956, compared with 14 percent in 1955. France, Switzerland, and Austria all have extensive eradication programs.

In the fight against brucellosis, testing, vaccination, and sometimes slaughter of reactors are employed. Control schemes are in effect in several countries. Norway had succeeded in practically eradicating brucellosis in the late 1930's. In 1950 only two infected herds were found in that country. In Sweden in the same year the incidence was down to 1 percent of the herds. Denmark in the early 1950's still reported brucellosis as one of the diseases estimated to affect more than 10 percent of the national herd, but, owing to measures carried out in the last few years, the disease is expected to be practically eradicated by early 1957. In the Netherlands, as areas were successfully freed of tuberculosis, control measures against brucellosis were organized. The United Kingdom has a calf vaccination scheme, under which the government pays part of the cost of vaccination for heifer calves of certain age. The number of calves vaccinated increased from 396,000 in 1953 to 450,000 in 1955.

Foot-and-mouth disease has staged extensive outbreaks from time to time in West Europe, the last one in 1951–52. Because of the seriousness of the disease and the danger of its spreading to disease-free areas, strenuous efforts have long been made by individual countries to combat it. To aid in the fight at the international level, a European

Commission for the Control of Foot-and-Mouth Disease was established in 1954.

The method of control varies from country to country. In the United Kingdom the disease is not endemic, and a policy of slaughter and restriction of movements of animals has been successful in checking it when it appears, spreading from other countries. Norway, Sweden, and Switzerland also follow a slaughter policy.

In countries where the disease is of long standing, killing of all animals that contract the disease is considered too costly, but vaccination—in some countries performed annually—and quarantine or other regulations limiting the movement of animals have contributed greatly to keep the disease within bounds. In France and West Germany, vaccination programs are in effect for cattle on infected farms and in adjoining areas and in certain other specified situations. West Germany is establishing a new Federal Research Station for Virus Diseases of Animals, consisting of a microbiology department, a chemistry-physics department, an immunology department, an epidemiology department, and a vaccine quality control and virus-typing department. The seriousness of the 1951 epizootic of foot-and-mouth disease reportedly provided the final stimulus for the plans to establish this center, and it will be the government center for the typing of foot-and-mouth disease virus. It is planned to develop a foreign exchange research program, and the station is set up to accommodate foreign research workers.

Outbreaks in the most recent years have not been numerous in northwestern Europe. The total in 1955 was 3,032, of which 2,441 occurred in France. This compares with a total number of outbreaks in 1951 and 1952 of 257,292 and 409,096, respectively. In late 1956 and 1957 a slight increase in the incidence of the disease occurred, and the European Commission for the Control of Foot-and-Mouth Disease at a recent session mapped out a campaign for the fight against this disease, relying on reinforcement of the measures already in use.

Less spectacular in its manifestations, mastitis nevertheless causes serious losses due to reduced milk yield in some countries. Because of the complexity of the disease—many different micro-organisms appearing as the cause of the infection—the problem of control must be tackled on many fronts, and complete eradication does not appear possible.

Mastitis associated with *streptococcus agalactiae*, now commonly treated with antibiotics, is most susceptible of cure. Attention is therefore focused on other forms of the disease. For these, medications have been found useful in certain cases, but, at the present stage, practicing strict measures of hygiene in the stable is the main approach to limit the occurrence of the disease.

Swine fever (hog cholera) is another disease which has been a serious menace in the past but is now successfully treated through

immunization. The reported number of outbreaks in recent years has been: In 1952, 5,977; in 1953, 5,623; in 1954, 5,300; in 1955, 4,467—a steady decline despite rising hog numbers.

Other Rationalization Measures

In the rationalization of farm practices in West Europe, three problems are of major significance, all difficult and costly to correct: The small size of a great number of farms, the scattered location of the land of many farms, and outmoded farm buildings. Though these obstacles to modern farm practices are not new, they have become increasingly serious ones as the postwar shortage of labor and the prevailing high wage rates have intensified the need for increased mechanization. The economic importance of location of land in relation to the farm is indicated by a Danish study, which for 1954–55 established the relative level of net return per hectare of land according to distance. The result is a reduction of 9 percent in net return per hectare if a plot is located at a distance of one kilometer (0.62 mile) from the farm, 25 percent if the distance is 2 kilometers, and 34 percent if the distance is 3 kilometers.

To be successful, efforts to consolidate scattered parcels of farmland and to amalgamate small farms generally require strong incentives, including financial support; mandatory compliance under certain circumstances is important. Legislation on these matters is therefore essential. A number of countries have enacted such legislation in recent years or strengthened existing legislation. West Germany, France, Sweden, and Switzerland, for instance, have active programs. Though progress of necessity is slow, achievements under the programs have been substantial.

In West Germany, postwar land reforms reduced the number of holdings over 250 acres in size. At the same time, there has been a decrease in the number of small farms (those under 25 acres), whereas the number of farms 25–50 acres in size and 50–62 acres in size increased between 1945 and 1955. During the same period consolidation of fragmented farms took place at a gradually increasing rate so that, by the end of 1955, over 2.7 million acres of land had been subjected to consolidation. This amounts to about 8 percent of all agricultural land. Improved roads and drainage are usually included in the consolidation procedure. Another 10 million acres is still in need of consolidation.

French farms also suffer from excessive fragmentation, estimated in the 1946 report of the Commission for Rural Modernization and Equipment to be a serious problem for over 25 million acres, or about one-third of the land in agricultural use. By December 31, 1955, consolidation had been completed for 4.6 million acres (mainly in areas of intensive cultivation), was under way on 1.8 million acres,

and was planned for an additional 3.5 million. Consolidation operations include not only the regrouping of plots, but also bringing together land and farm buildings, where possible, and providing roads and drainage.

In Switzerland, land consolidation takes place under cantonal legislation for facilitating the use of agricultural land, and is financially assisted by both the federal and the cantonal governments. As in other countries, the rate of consolidation has increased since the war. During the 10-year period 1946–55, a total of 250,000 acres of farmland was involved in consolidation projects. This land before consolidation consisted of 347,000 plots; consolidation reduced this number to 89,000. Here, also, road construction and drainage is made a part of the consolidation process.

Swedish postwar land legislation has had as its primary aim to reduce the number of small uneconomic farms. Swedish agricultural policy entails considerable protection, but, to confine the degree of protection and to avoid large surpluses, it is the aim of current policies to set prices at such levels that costs will be met on well-managed farms of 25–50 acres. It is felt that a large number of the farms of under 25 acres—though not all by any means—are uneconomic, and the amalgamation of such units into fewer and larger ones is considered the only effective approach to rational farming.

Under an Act of 1947, Sweden set up institutions to purchase and redistribute land, creating holdings of over 25 acres from smaller ones. A comparison of the number of holdings in 1944 and 1951 shows a total decline by 35,646 holdings in that period (8.6 percent of the total), with the following percentage changes for various size groups:

Size group (Acres)	*Percentage change*
0.6– 2.5	−24
2.5– 5	−13
5 – 6.2	−11
6.2– 25	−5
25 – 50	+2
50 – 75	+4
75 –125	+5
125 –250	+7
Over 250	

A sample survey in 1952 showed a further decline of over 15,000 holdings of 5–25 acres and an increase in large size groups. Thus, this "external rationalization" appears to be well under way, aided by a high level of economic activity in other industries and a rapid population movement from country to town.

Norway in 1955 passed a law which provides measures to increase the average size of farms by amalgamating small farms and helping farmers to buy additional land, as well as to prevent splitting up of

existing farms. Belgium and the Netherlands also have legislation encouraging land consolidation. In the United Kingdom and Denmark the problem of fragmented farms is not serious, because the enclosure movements of past centuries and inheritance laws resulted in a more favorable farm layout. But the amalgamation of small farms with other land in the United Kingdom is among the aims of legislation on long-term assurances for agriculture, introduced into Parliament early in 1957.

Probably the most difficult and costly problem in increasing the productivity of European farming is that of modernization of farm buildings. Yet it is essential for the desired rationalization of farm practices.

A French study of 1950 showed that the average age of farm buildings in Normandy was as much as 137 years, and in none of the French regions studied was it less than 84 years. Though this may be extreme, all European countries are faced with the problem of old buildings in varying degrees. Furthermore, normal replacements and maintenance in many places have been neglected, owing first to the depression and later to war conditions and to material shortages in the immediate postwar years, as well as to the need for heavy investment in machinery and other types of equipment after the war. Where landlords are responsible for building improvements and rents are controlled or for other reasons have remained at low levels, out of line with rising building costs, this situation has tended to prevent desirable building maintenance.

To the need for replacements must, of course, be added the need for structures suited to present-day requirements for storing feedstuffs (more home-grown feeds, such as silage) and changed feeding practices, and for storage and care of equipment and machinery. Above all, on most farms a more rational layout of the buildings, taking into account up-to-date labor-saving organization of the work, is an urgent requirement. The need for buildings of lighter materials and more flexible character than were formerly employed is also recognized.

The importance of adequate buildings of efficient layout is a matter of much concern, as is evidenced by the increasing attention paid to it in West Europe. According to a German source, 70 percent of all farm work on a medium-sized holding is carried out in and around the farm buildings. Rationalization of this large share of activities depends to a large extent on the layout and condition of the buildings.

The existence of official organizations charged with problems of farm buildings bears witness to efforts to tackle this important question. As early as 1937, Sweden set up a governmental Research Committee for Farm Buildings—now the Research Institute for Farm Buildings, located at Lund. Furthermore, the Agricultural Division of the Board of Agriculture has a section for building problems.

Locally the board works through County Agricultural Councils, whose staffs of specialists include building consultants. The government provides grants and credits for certain farm building purposes.

The aim of Swedish farm building research, advisory activities, and financial support has been closely connected with farm rationalization and mechanization. Many factors have contributed to the active program in Sweden, in addition to a general awareness of the importance of the problem. First, perhaps, the exceptionally high cost of labor and heavy loss of agricultural population, as well as the high degree of mechanization, have made rationalization of farm work especially urgent. The consolidation of small farms has created special needs for new buildings, and the agricultural policy pursued during the 1940's and early 1950's favored such activity. Farm prices during that period were set on the basis of a constant relationship between total farm income and total farm costs, so that increased costs (interest and depreciation) due to new building, generally speaking, would be compensated for.

Other countries have created institutions with purposes similar to the Swedish ones. In West Germany, for example, in 1952 the federal government assisted in the creation of a so-called Research Cooperative for Farm Building Problems in Frankfurt. The following year an Institute for Farm Building Research was set up by the government within the agricultural research center at Völkenrode, patterned after the Swedish institute at Lund. There, too, problems of building techniques are considered an integral part of the broader problem of farm rationalization.

In Denmark, farm organizations early in 1930 suggested the creation of a commission which was to work out plans for better farm building arrangements, resulting in construction of some T-shaped and L-shaped farm structure layouts, departing from the common layout around a square. In recent years the National Building Institute has collaborated with the Farm Management Bureau on studies of farm buildings and made recommendations, especially concerning building of stables. Other efforts to encourage better farm buildings include the introduction of this subject in several agricultural schools, and the addition during the past 10–15 years of building specialists to the advisory services of a number of farm organizations.

The European Productivity Agency (EPA)—an agency of the OEEC—has also taken up the problem of farm buildings, and has organized a project on remodeling and adaptation of farm buildings. The participants in this project studied technical problems related to farm buildings in the United States, as well as the methods used by the United States Extension Service to instruct farmers in building requirements and ways of meeting them.

One of the newly adopted practices in the interrelated fields of farm buildings and farm management, which has been the subject of con-

siderable research and experimentation in a number of countries in recent years, is loose housing of cattle. Opinions are divided on the merits of the system. Adaptation of old farm buildings to the requirements of the loose housing system has not been found too difficult. Whether or not construction of new buildings for loose housing is less expensive than construction of conventional stall-type stables is apparently an open question. There seems to be quite general agreement among West European specialists on the fact that loose housing results in considerable labor saving, but also in increased feed consumption per unit of milk produced. According to discussions by representatives of the OEEC countries at a training course in cattle feeding and management in 1954, loose housing still needs much more study before its advantages and disadvantages under the conditions prevailing in northwestern Europe can be definitely established. In the meantime, many farmers are adopting it.

Efforts to rationalize farm work, in addition to measures concerned directly with land and buildings, include to an increasing degree the study of work simplification and labor management as well as the broad subject of farm management. A seminar held in the Netherlands in 1956 under EPA auspices dealt with work simplification and labor management on farms and included practical demonstrations at the Dutch Institute for Agricultural Engineering and Rationalization at Wageningen. The participating groups developed a set of basic principles to guide countries in the application of work simplification and labor management on farms. A continuing exchange of information and ideas among the various institutes which work in this relatively new field is planned, and all relevant material will be supplied to the advisory services and vocational schools in the OEEC area. It is considered that a program for training farmers in the use of practical techniques for simplification of farm work should be included in all advisory programs.

In EPA's work on agriculture, similar emphasis is placed on the problem of farm management, and specifically on the role that the advisory services can play in promoting farm management work. A team of West European agriculturalists recently studied the principles of farm management in the United States, including extension methods which have been found effective in getting such principles applied. Also, United States farm management consultants have been employed by EPA to assist temporarily in developing national farm management programs. This work is given high priority.

It is of course impossible to evaluate in concrete terms the contribution which the expanded postwar advisory services in West Europe have made to the area's rising productivity, but it is generally recognized as being a substantial one. None of the individual factors of technological progress discussed here could have found practical ap-

plication on West Europe's farms, to the degree they did, without the guiding and stimulating influence of the advisory services and of the progressive farmers' separate experimental and advisory organizations. Many European specialists in the varied fields associated with farming are of the opinion that further strengthening of this essential link between science and farming will be one of the most important factors in the continuing efforts to rationalize farm work and improve the productivity of the area's agriculture.

The Growth of Productivity

The adoption of modern practices in West Europe has increased the costs of farming as well as the returns. But it has also increased output per unit of input, or productivity.

How to measure the increase in agricultural productivity is a problem, for there is no agreement on any one yardstick,[10] and whatever the yardstick chosen—output per unit of total input, output per unit of labor input, or value added per unit of labor input—its computation and use are handicapped by gaps in the basic data needed for productivity measurement. Still, sufficient material is at hand to form an idea of the direction and the broad magnitudes involved in the growth of agricultural productivity in West Europe.

A number of studies of the subject have been made in individual countries or for groups of countries. The results of a few are summarized here. They have been selected with a view to throwing some light on differences in productivity as among individual farms of a region or a country, or among countries, and over time. They have further been selected in such a way as to afford at least a general impression of the extent of productivity growth after the war—of the broad quantitative impact that the application of technological improvements has had upon the output and profitability of agriculture.

Like many other areas of the world, West Europe shows large differences in productivity, not only among countries but also among regions within a country, and even among individual farms of the

[10] This was brought out at the Ninth International Conference of Agricultural Economists held at Otaniemi (Finland) in 1955; the conference devoted most of its time to the very theme of technical change in agriculture. Having contemplated some of the main papers, Professor J. Horring of the Netherlands commented: ". . . we are talking about technical progress and productivity and still have no yardstick with which to measure them. In science it is generally believed that it is only when you can measure a thing or count it that you have progressed. So I think that we shall have to start at the beginning again and try to find a yardstick with which to measure productivity . . . I will not try to give a solution here. I propose that five or ten interested people should meet to thresh out this problem and report to the Conference." *Proceedings of the Ninth International Conference of Agricultural Economists*, p. 104, Oxford University Press, London, 1956.

same region and with the same natural and economic environment. It is this fact more than any other that makes students of the problem believe that there are still great unexploited reserves of productivity in European agriculture, and that further substantial increases in productivity and total production are certain.

A few figures may suffice to give an idea of the degree of dispersion of productivity in the agriculture of West Europe. Accounting studies in the Eastern Counties of England for 1955–56 showed income (profit) per acre on "premium" farms about 50 percent above "average" farms—for mixed livestock enterprises, even 100 percent above.[11] "Value added" per labor unit ("net productivity of labor") on grain-row crop farms in northwest Germany, 1955–56, was 60 percent higher on farms of 125 acres or more than on farms up to 25 acres in size. Grain-row crop farms, 125 acres and over, in northwest Germany showed labor returns 40 percent above those of the same type and size in south Germany.[12] Net profit per acre in the plains of south Sweden on farms 75 to 125 acres in size was 40 percent above that in the 25- to 50-acre group.[13] A study made at Grignon, France, indicated an extraordinary spread of net profit per hectare between average and top-level management for farms of identical size and the same natural and economic environment.[14]

Differences in agricultural productivity among countries reflect differences in economic and agricultural policies and particularly differences in natural conditions, farm sizes, types of farming, and organization of production—the managerial factor that mainly accounts for the various ways in which factors of production are combined. The table below, with results of four of the several calculations available for groups of countries, indicates the magnitude of the spread in productivity that exists. It also points up the divergence of results that can be obtained by the use of different basic data and, in some instances, different measuring methods.

There is no doubt that Denmark has far and away the highest

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[11] *Report on Farming, 1955–56.* A study of production and profits in the Eastern Counties with an advisory supplement and efficiency standards, issued by Farm Economics Branch, School of Agriculture. Cambridge Univ., February 1957.

[12] *Bericht ueber die Lage der Landwirtschaft* (*Gruener Bericht 1957*), Bonn, Feb. 15, 1957.

[13] Results for 1950–51 for bookkeeping enterprises, as per Gustav Lau, *Erfolgreiche Rationalisierung*, Hamburg and Berlin, 1955.

[14] This statement is based on information obtained in personal discussion with Professor Jean Chombart de Lauwe, of the Grignon School of Agriculture. In the meantime, it is understood, the results of the study appeared in: J. Chombart de Lauwe and J. Poitevin, *Gestion des Exploitations Agricoles*, Paris (Dunod) 1957, 232 pp.

West Europe: Indices of labor productivity in agriculture

Country	Krohn [1] 1949–50	INSEE [2] 1936–38	Moore [3] 1931–35	Clark [4] 1934–35
Denmark	100	100	100	100
Netherlands	56	98	66	83
United Kingdom	----------	75	57	90
Belgium	----------	73	80	79
Germany (West)	49	71	65	70
France	38	56	54	70

[1] H. B. Krohn, "Die Produktivitaet der Landwirtschaft im Europaeischen Vergleich" *in* Agrarwirtschaft, April 1953 (Hanover). The data are for "Value added per labor unit employed." They are for the most recent of the periods shown in this tabulation, 1949–50. Since then the productivity values for the other countries in relation to Denmark have probably increased. Yet a wide disparity no doubt persists. Data were converted to Denmark=100.

[2] Institut Nationale de la Statistique et des Etudes Economiques (Paris). *Cf.* Bulletin de la Statistique de la France, Sup. April–June 1948. The data are for total farm output value "per active male" in agriculture; they were converted to Denmark=100. The Institute also made calculations "per active person" (male plus female), but these were considered less satisfactory and therefore omitted. The figure for the Netherlands seems much too high.

[3] W. E. Moore, *Economic Demography of Eastern and Southern Europe*, League of Nations, 1945. The data refer to 1931–35 and are for "value added per male occupied in agriculture"; they were converted to Denmark=100. Colin Clark (see reference in [4]) expressed Moore's "crop units" in terms of his own "international units," and this is the source from which the above Moore index was computed (Denmark=100). Moore's figure for Belgium seems too high; that for the Netherlands, too low. Also, *see* "Comparaisons Internationales Sur Les Productivités Agricoles" in Bulletin Mensuel de Statistique, sup. July–September 1954 (Paris).

[4] Colin Clark, *The Conditions of Economic Progress, 2nd ed.*, London, 1951. The data refer to 1934–35 and are for "value added per male occupied in agriculture," as per table opposite page 200; they were converted to an index with Denmark=100. Clark's figures for the United Kingdom (Great Britain in his table) and for France seem too high.

European Analysis Branch, Foreign Agricultural Service, May 1957.

output per unit of labor input. This superiority in agricultural productivity in West Europe is held by the only country there that is almost completely free of government regulation of agricultural production and markets. Denmark also has larger farms, on the average, than any West European country save the United Kingdom.

Difficult as it is to glean from available material an idea of the precise differences in agricultural productivity as between countries, measures of the increase in productivity that has taken place over time are still more tentative.

The United Kingdom Government "broadly" estimates the increase in farming efficiency, arising primarily from improvements in husbandry and farm managements, at something like £30 million annually, over the past several years, or about 2 percent of gross output.[15]

In a study of labor productivity, H. T. Williams found that net output of United Kingdom agriculture had increased by 39 percent per man-hour from 1937–39 to 1952–53; the increase to 1945–46 had been 5 percent. The annual rate of increase between 1945–46 and 1952–53 thus was about 4 percent. These results were calculated

[15] *Annual Review and Determination of Guarantees*, 1956, Cmd. 9721, March 1956, p. 3. See also *Annual Review, 1955*, Cmd. 9406, March 1955, p. 9.

with physical units of output and input valued at the prices of 1945–46.[16] An idea of the changes in the combination of factors of production that had occurred in the United Kingdom since before the war is afforded by these data: Imports of feedstuffs declined to half their prewar volume; man-hours of employment (after an increase to 9 percent over prewar by 1944–45) declined to 7 percent below prewar; machinery depreciation (at constant prices) rose by 170 percent, fuel use by 360 percent, and the input of nitrogen by 260 percent.

In a study of 20 identical farms for 1955 and 1935 the Farm Economics Branch of Cambridge University adjusted 1935 costs and prices to 1955 levels in order to isolate the factor "better farming" as a determinant of profit. It was found that farm income (profit) had increased from £363 to £1,610 per farm. Of this increase, £531 was due to changes in the general level of prices. "The remainder (£716) is due to better farming."[17] Farm income had increased from 19 to 27 percent of total input or costs. This means that the cost of producing a unit of output has decreased by 7 percent in terms of physical inputs (labor, power, other resources).

A sample of 51 farms in the south of England studied by the Department of Agricultural Economics of the University of Reading[18] revealed an increase in farm income (profit) per 100 acres from £60 in 1943 to £294 in 1951–53, corrected for changes in price and cost levels. This means an increase of farm income from 2.3 percent of total input or costs in 1943–45 to 10.6 percent in 1951–53. It also means that the cost of producing a unit of output has decreased by 7 percent, or that output per unit of input increased by 8 percent, roughly 1 percent per year.

An index of "total productivity in agriculture" and of "net productivity of labor" in agriculture for Denmark, calculated by P. Dossing,[19] showed increases by 25 percent in total productivity (output per unit of input), or roughly 1½ percent per year, and by 60 percent in the net output of labor, or roughly 3 percent per year, between 1935–39 and 1950–54. The increases between 1945–49 and 1950–54 were of course much higher: 3¼ percent per annum in total productivity, and 11 percent per annum in productivity of labor.

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[16] H. T. Williams, *Changes in the Productivity of Labour in British Agriculture.* Paper read at the Agricultural Economics Society meeting in July 1953. This paper contains a number of lucid definitions, explanations, and reservations about the concepts of productivity and about the calculations given.

[17] *Report on Farming, 1955–56*, op. cit., p. 9.

[18] C. H. Blagburn, *Changes in the Economy of 51 Farms in the South of England, 1943 to 1953.* Reading, January 1957.

[19] "Productivity and Calculations of Productivity in Danish Agriculture," *Tidsskrift for Landøkonomi*, Nos. 11–12, 1953; the calculations were later brought up to 1954.

Speaking of the Scandinavian countries, K. U. Pihkala reported that, "using the data of Swedish 'total accounting,' Holmström estimates the volume of production, 1953–54, as 112.1 percent of the corresponding volume in 1938–39 corrected for normal yields. The costs of production are 89 percent, and the rise in productivity thus 26 percent." [20] This also implies an annual increase in total productivity by 1½ percent, in labor productivity by 2.3 percent, compared with prewar. In Norway the rise of net productivity of labor from 1938–39 to 1950–51/1953–54 was 32 percent,[21] an annual increase by 2 percent.

Padberg and Nieschulz, and the late Dr. Thiel, have made extensive and detailed calculations of production, receipts, and expenditures in West Germany's agriculture. Although these calculations do not aim at calculating productivity and do not, in any case, present such computations, they can, with certain reasonable transformations and adjustments, be used to give a general idea of the magnitudes involved. On this basis it would appear that output per unit of input increased by about 2½ percent per annum over the period 1949–50 to 1955–56, productivity of labor by about 5 percent per annum.[22] Calculations made by the Austrian Institute for Economic Research [23] for the period 1950 to 1955 showed an average annual rate of increase in labor productivity by 4 percent.

These examples must suffice for a general impression of the development of agricultural productivity in important segments of West Europe in recent years. Taking trend values of yields, total agricultural production from around 1950 to around 1956 increased by about 16 percent. Of this increase about one-fifth may have been due to increased total input (more capital, less labor), while four-fifths may have been due to higher productivity. The annual rate of the increase in total output was around 2½ percent during that period; the annual increase in total productivity (output per unit of input) may have averaged 2 percent. Because of an average annual decline of

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[20] *Proceedings of the Ninth International Conference of Agricultural Economists*, Oxford University Press, London 1956, page 30. *See also* Sven Holmström, *Fakta om Jordbrukspolitiken*, Stockholm, 1954.

[21] Ibid., p. 30.

[22] K. Padberg and A. Nieschulz, "Produktion, Verkaufserlöse und Betriebsausgaben der Landwirtschaft im Bundesgebiet," *Agrarwirtschaft*, February 1957. See also *Statistisches Handbuch—Landwirtschaft und Ernahrung*, Hamburg and Berlin, 1956. (Incidentally, this volume of agricultural statistics is exemplary in its logic, systematic presentation, and abundance of quantitative information.) The transformation and adjustment of Padberg's and Nieschulz's data consisted mainly in estimating wages in kind for both family labor and hired labor, and excluding expenditure for investment.

[23] *Produktionsvolumen und Produktivitaet der Oesterreichischen Landwirtschaft*, Oesterreichisches Institut fuer Wirtschaftsforschung, Wien, 1956.

about 1¾ percent in the farm labor force, labor productivity (output per unit of labor input) must have risen by around 4 percent per annum. This latter rate is so high because this particular type of calculation expresses the *total* increase in output in terms of *labor* input, though increases in other inputs have contributed to the results.

A summary of these estimates is given in the following table.

West Europe: Index of estimated input/output developments

[Input and output around 1950=100]

Period	Input			Output	Output per unit of input=total productivity [1]	Output per unit of labor input=labor productivity [1]
	Labor	Nonlabor	Total			
Relatives:						
Around 1950 (base period)	65	35	100	100	1. 0	1. 0
Around 1956	59	44	103	116	1. 12	1. 28
Percent changes: [2]						
Over the period (6 years)	−10%	+26%	+3%	+16%	+12%	+28%
Average annual rates (compound)	−1¾%	+3⅞%	+½%	+2½%	+2%	+4%

[1] Base period=1.
[2] Increases (+), decreases (−).

European Analysis Branch, Foreign Agricultural Service, May 1957.

The estimates relate to West Europe as a whole and, as has been shown, there are differences among countries. But both input and productivity have increased in all of them except Sweden. In that country, policies did not aim at further expansion of output; as a result, *total* inputs did not increase, although productivity did; labor input continued to decline.

It should be kept in mind that, if the comparisons for 1956 were to relate to prewar instead of 1950, the results would necessarily show much smaller annual rates of increase in output, in total productivity, and in labor productivity over the whole range of that period. The war years, in most countries, were years of decline, not of increase.

While the estimates are tentative and, because of the limitations in quantity and quality of the basic material, subject to a substantial margin of error, they can be taken to indicate the general order of the magnitudes involved. They have been tested for consistency in many ways. Consistency was sought among such elements as share of labor input and nonlabor inputs in total inputs; increase in nonlabor inputs and decrease in labor input; increase in total productivity in the light of increases in nonlabor inputs and in total inputs; and the like. These tests were helped by reasonably firm data on total output and on labor input, hence also on labor productivity. Consist-

ency was also sought between these estimates and the returns, or partial returns, for individual countries and the latters' weight in the totals for West Europe. Yet, much must remain tentative and subject to revision as more and better data become available. And in some respects, calculations of this type, which compress into a few figures indications of a number of highly complex developments, will always have to be used "very conservatively and with many reservations," to borrow H. T. Williams' phrase.[24]

It must be kept in mind specifically that an estimate of total productivity (output per unit of input) is determined by a number of prior estimates, among which are estimates of the components of total output and total input. Input as well as output must be represented in physical terms—meaning that all components must be shown, through time, in terms of values at constant prices. If price relationships among the various components of output and input change radically over the period for which comparisons are made, the results as to changes in output and input, and hence as to changes in productivity, may differ a great deal depending upon which price pattern is chosen: That of the base year, or that of the comparison year, or some other pattern. For example, the price relationship between a unit of labor input and a unit of nonlabor input chosen for the above calculations was approximately that of the year 1950. Between 1950 and 1956 the price of farm labor rose considerably in relation to that of a nonlabor input unit.[25] Had the price relationship of 1956 been chosen for the calculations, the share of labor input in total input would have appeared higher, with the result that the increase from 1950 to 1956 in total input would have been smaller, the increase in productivity larger, while the increase in labor productivity would not have changed significantly.

A final comparison, so far as feasible, with figures for the United States[26] is of interest. In some ways West Europe's period 1950 to 1956 is more comparable to 1940–1947/49 (period A) than to 1947/49–1955 (period B), in the United States. The annual increase in total output in West Europe from 1950 to 1956 of 2½ percent was roughly comparable to that in the United States in period A, 2⅜ percent. The decline in the farm labor supply in West Europe, 1¾ percent per year, was less than in the United States in either period (2¼ percent).

Labor productivity in West Europe increased by about 4 percent

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[24] H. T. Williams, op. cit., p. 7.

[25] This fact is shown by the statistics for input items in all countries.

[26] *Changes in Farm Production and Efficiency*, 1955 Summary, U. S. Dept. Agr., Agr. Res. Serv., June 1956; and *Possible Methods of Increasing the Parity Formula*, Report of the Secretary of Agriculture, Pursuant to Section 602 of the Agricultural Act of 1956, Washington, D. C., 1957.

per year, or almost as much as in the United States in period B (4⅛ percent); the United States increase in period A (4¾ percent) was definitely higher.

Comparisons with preliminary estimates for the United States of the annual increase in input (which for West Europe is estimated at about ½ percent) and of the annual increase in productivity (2 percent for West Europe) also yield a reasonable picture.

To sum up, progress in technology has offset a formidable decline in the agricultural labor force and been translated into large increases in production and productivity. West Europe's agricultural expansion after the war and in the post-recovery period has indeed been remarkable.

The estimated rates of growth in total production, total productivity, and labor productivity accord very well with such extraordinary developments as a ninefold increase in the number of tractors and a 78-percent increase in the input of fertilizer compared with prewar. And they also accord with such examples of progress by advanced farmers as are afforded by the increased share of agricultural land under mechanized management in Denmark, from 34 percent in 1950 to 73 percent in 1954; by the increase in total farm draft power by almost 60 percent from 1948 to 1954 in Great Britain—also a country of relatively large farms; and by the increase in West Germany—a country of small- to medium-sized farms—of the share of mechanized draft power from 13 percent of all draft power in 1949 to almost 60 percent in 1957.

Better farming still faces many problems in West Europe. But the record of the past, especially of the last 10 years, furnishes ample evidence that, given favorable economic conditions, West European agriculture can overcome to a large extent the obstacles to technological progress that are inherent in a farm structure with strong roots in the past.

The Years Ahead

Forecasts of economic development are always hazardous, be they based on historical analogy, on extrapolation of what is thought to be a trend, or purely on intuition or that kind of "feel" for the realities and potentialities of a situation that is a rare gift possessed by only a few. However, a brief reference will be made to the outlook for the next few years since a survey like the present one would not seem complete if no word were said about prospective developments for a longer period of time ahead.

Opinions as to the extent of probable further expansion in West

Europe's agriculture over the next decade or so must necessarily differ. But few will quarrel with the view that the growth of total output and of productivity is likely to continue at high rates. The growth of labor productivity will continue to exceed the growth of total output, as it did over the period 1950 to 1956. And there is a possibility that productivity may account for an even larger part of the increase in total output than it did in 1950 to 1956. However, the rates of increase—while continuing high—will probably slow down compared with the remarkable expansion of 1950–56.

If the reasons for these expectations were to be condensed into a few words, they might be stated as follows: on the productivity side, the momentum that technological improvement has by now acquired will be a positive influence; on the side of total output, certain market limitations may become a retarding factor.

More specifically, the momentum of technological progress will be reinforced by the continued outflow of labor from agriculture into growing industries and service trades. That there is much room for further increases in productivity is attested by the great differences that now exist even among farms of identical size and the same natural and economic environment. Progressive farmers themselves will of course continue to make use of new findings of science.

With respect to total output, market limitations may become a retarding factor. Total farm output, no doubt, will continue to increase, but the rate of increase may slow down. The market limitations are indicated by a set of circumstances important to remember.

The income and price elasticities for agricultural products, in general, in the advanced economies of West Europe are low, though not as low as in the United States. And the high elasticities for the more expensive foods are rapidly declining. The average income elasticity of the demand for food (quantity at farm or import level) now stands perhaps at 0.35.

For the United Kingdom, Professor E. A. G. Robinson (in 1956) estimated the increase in the demand for food for 10 years ahead at only 12 percent, or a little over 1 percent per annum at compound rates.[27] For West Germany, Professor Arthur Hanau [28] estimates as the most probable an increase in per capita real income for the 10-year period of 3 percent per annum which, at an income elasticity of 0.40, would give an annual increase by 1.20 percent in the per capita demand for food at the farm level. The "probable" population increase is estimated at 0.60 percent. The total estimated increase in

[27] E. A. G. Robinson, *Agriculture's Place in the National Economy.* Paper read at Conference on Agriculture in the British Economy, held at Brighton, Sussex, Nov. 15–17, 1956.

[28] "Die langfristigen Absatzaussichten der westdeutschen Landwirtschaft bis 1965," by A. Hanau and H. B. Krohn, *Agrarwirtschaft,* Heft 9 and 10, 1956.

demand for food would thus be a little under 2 percent per annum.

If the rest of West Europe as here defined shows a growth of the demand for food between the 1.8-percent rate estimated for West Germany and the 1.1-percent rate estimated for the United Kingdom,[29] this expansion would not suffice to sustain a rate of growth in output of the proportions observed in 1950–56.

It is unlikely that policies will or could promote an increase in food output sufficient to cover fully the increase in demand, for a leveling off or decrease in imports of food and feed would hamper increases in exports of manufactures, which are basic to the maintenance and growth of West Europe's economic prosperity. In his calculations for the next 10 years, Professor Hanau assumed that the *share* of imports in West German supplies of livestock products would remain unchanged, i. e., that the volume of imports would increase; for grains he assumes a decrease in imports. Professor Robinson, taking a pessimistic view of prospects for British exports, thinks that home production will have to supply most of the increase in Britain's demand for food.[30] Professor E. F. Nash, on the other hand, believes it probable, in present circumstances, that Britain's farm output is above the optimum and that there would be some economic advantage to the country in releasing from agricultural use some of the resources absorbed by British farms in recent years.[31] Britain, like most other West European countries, is now emphasizing increased efficiency rather than increases in total output.

This, then, is the present prospect for the years ahead: The rates of further expansion in total farm output will be somewhat less than the rates observed in the immediate post-recovery period. But, because of the momentum of technological progress, productivity will further rise and this will make West Europe's farm production more genuinely competitive, even without intensification of government support. It is important to be aware of this prospect in an area that is the world's largest importer of agricultural products and that, in recent years, has taken nearly 40 percent of United States agricultural exports.

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[29] Say, France, Austria, the Low Countries, and Ireland between 1.50 and 2 percent, the Scandinavian countries and Switzerland somewhat over 1 percent.

[30] E. A. G. Robinson, op. cit.

[31] E. F. Nash, *The Sources of Our Food Supplies.* Paper read at Conference on Agriculture in the British Economy, held at Brighton, Sussex, Nov. 15–17, 1956.

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